

P E N N S Y L V A N I A

Occupational Outlook Handbook

**2006
Edition**

Agriculture & Natural Resources

Manufacturing

Technical & Repair Services

Volume 3 of 6

TABLE OF CONTENTS

How to Use the Pennsylvania Occupational Outlook Handbook

Agriculture & Natural Resources

Introduction

Agricultural & Food Scientists

Conservation Scientists & Foresters

Farmers, Ranchers & Agricultural Managers

Forestry, Conservation & Logging Occupations

Handlers, Equipment Cleaners, Helpers & Laborers

Inspectors & Compliance Officers

Landscape Architects

Landscaping, Groundskeeping, Nursery, Greenhouse & Lawn Service Occupations

Material Moving Equipment Operators

Pest Controllers

Powerplant Operators, Distributors & Dispatchers

Stationary Engineers & Boiler Operators

Veterinarians

Veterinary Assistants & Non-farm Animal Caretakers

Veterinary Technologists & Technicians

Water & Liquid Waste Treatment Plant & Systems Operators

Manufacturing

Introduction

Apparel Workers

Bindery Workers

Blue-Collar Worker Supervisors

Drafters

Handlers, Equipment Cleaners, Helpers & Laborers

Industrial Production Managers

Inspectors, Testers, Sorters, Samplers & Weighers

Machinists
Metal & Plastics Machine Operators
Painting & Coating Workers
Precision Assemblers
Prepress Technicians & Workers
Printing Machine Operators
Production, Planning & Expediting Clerks
Shoe & Leather Workers & Repairers
Structural & Reinforcing Metal Workers
Textile Machinery Operators
Tool & Die Makers
Welding, Solderers & Brazing Workers
Woodworkers

Technical and Repair Services

Introduction

Aircraft & Avionics Equipment Mechanics
Automotive Body & Glass Repairers
Automotive Service Technicians & Mechanics
Blue-Collar Worker Supervisor
Coin, Vending & Amusement Machine Servicers & Repairers
Computer, Automated Teller & Office Machine Repairers
Diesel Engine Technicians & Mechanics
Electrical & Electronics Installer & Repairers
Electronic Home Entertainment Equipment Repairers
Farm Equipment Mechanics
Handlers, Equipment Cleaners, Helpers & Laborers
General Maintenance & Repair Workers
Home Appliance Repairers
Industrial Machinery Repairers
Line Installers & Repairers
Millwrights
Mobile Heavy Equipment Mechanics
Precision Assemblers
Radio & Telecommunications Equipment Installers & Repairers
Small Engine Mechanics

Auxiliary aids and services are available upon request to individuals with disabilities.
Equal Opportunity Employer/Program

Contact the Center for Workforce Information & Analysis for alternate formats at workforceinfo@state.pa.us, (717) 787-6466 or toll-free at 1-877-493-3282.

How to Use the Pennsylvania Occupational Outlook Handbook

The *Pennsylvania Occupational Outlook Handbook* is best used as a reference; it is not meant to be read in its entirety. Instead, look in the Table of Contents for specific occupations that interest you. For any occupation that sounds interesting, use the *Handbook* to learn about the type of work, education and training requirements, advancement possibilities, earnings, job outlook, and related occupations. Each occupational description follows a standard format, making it easy for you to compare occupations.

This document provides an overview of how the occupational articles are organized in the *Handbook*. It highlights information presented in each section and offers tips on how to interpret the information.

Unless otherwise noted, the source of employment and earnings data presented in the *Handbook* is the Pennsylvania Department of Labor & Industry, Center for Workforce Information & Analysis. Nearly all *Handbook* articles cite employment and earnings data from the Occupational Employment Statistics (OES) survey. Some articles include data from outside sources. OES data may be used to compare earnings among occupations; however, outside data may not be used in this manner because characteristics of these data vary widely.

The following are descriptions of the subheadings that appear under each of the occupations included in this handbook:

Significant Points

This section highlights key occupational characteristics.

Nature of the Work

This section describes what types of activities are involved in a particular occupation. Individual job duties may vary by industry or employer. For instance, workers in larger firms tend to be more specialized, whereas those in smaller firms often have a wider variety of duties. Most occupations have several levels of skills and responsibilities through which workers may progress. Beginners may start as trainees performing routine tasks under close supervision. Experienced workers usually undertake more difficult tasks and are expected to perform with less supervision.

Working Conditions

It is important to research the working conditions of an occupation. This section identifies the typical hours worked, the workplace environment, physical activities and susceptibility to injury, special equipment, and the extent of travel required. In many occupations, people work regular business hours - 40 hours a week, Monday through Friday - but in many others, they do not. For example, waiters and waitresses often work evenings and weekends.

Employment

This section reports the number of jobs the occupation provided in 2004 (nationwide and Pennsylvania) and the key industries where these jobs are found. When significant, the geographic distribution of jobs and the proportion of part-time (less than 35 hours a week) and self-employed workers in the occupation are mentioned.

Job Outlook

The long-term job outlook is a factor to consider when deciding on an occupation. This section shows anticipated growth or decline for an occupation in Pennsylvania by comparing actual 2004 employment figures with projected employment for 2014. In addition, this section describes the factors that will result in growth or decline in the number of jobs. In some cases, the *Handbook* mentions that an occupation is likely to provide numerous job openings or relatively few openings. Occupations that are large and have high turnover, such as cashiers and retail sales positions, generally provide the most job openings. Susceptibility to layoffs due to imports, slowdowns

in economic activity, technological advancements, or budget cuts are also addressed in this section. For example, employment of construction craft workers is sensitive to slowdowns in construction activity, while employment of government workers is sensitive to budget cuts.

Earnings

This section discusses typical earnings and how workers are compensated—annual salaries, hourly wages, commissions, piece rates, tips, or bonuses. Within every occupation, earnings vary by experience, responsibility, performance, tenure, and geographic area. Earnings data are from the Occupational Employment Statistics annual survey of Pennsylvania employers. Average hourly earnings for entry-level and experienced-level workers are now available as well.

Benefits account for a significant portion of total compensation costs to employers. Benefits such as paid vacation, health insurance, and sick leave may not be mentioned because they are so widespread. Though not as common as traditional benefits, employers may offer flexible hours and profit sharing plans to attract and retain highly qualified workers. Less common benefits also include childcare, tuition for dependents, housing assistance, summers off, and free or discounted merchandise or services.

Training, Other Qualifications and Advancement

Knowing what kinds of training or education are required for a job is an important part of career planning. This section describes the most significant sources of training, including the training preferred by employers, the typical length of training, and advancement possibilities. Job skills are sometimes acquired through high school, informal on-the-job training, formal training (including apprenticeships), the Armed Forces, home study, hobbies, or previous work experience. For example, sales experience is particularly important for many sales jobs, which may not require any education beyond high school. Many professional and technical jobs, on the other hand, require formal post-secondary education—vocational or technical training, or college, postgraduate, or professional education.

Also discussed here are the qualifications usually expected of job applicants, as well as opportunities for advancement or promotion. Some occupations require certification or licensing to enter the field, to advance, or to practice independently. Certification or licensing generally involves completing courses and passing examinations. Increasingly, many occupations have continuing education or skill improvement requirements to keep up with the changing economy or to improve advancement opportunities.

Related Occupations

Occupations involving similar duties, skills, interests, education, and training are listed.

Sources of Additional Information

No single publication can completely describe all aspects of an occupation. Thus, the *Handbook* lists mailing addresses for associations, government agencies, unions, and other organizations that can provide occupational information. In some cases, toll free phone numbers and Internet addresses also are listed. Links to non-BLS Internet sites are provided for your convenience and do not constitute an endorsement.

Auxiliary aids and services are available upon request to individuals with disabilities.
Equal Opportunity Employer/Program

Contact the Center for Workforce Information & Analysis for alternate formats at workforceinfo@state.pa.us,
(717) 787-6466 or toll-free at 1-877-493-3282.

Agriculture & Natural Resources

Agriculture & Natural Resources Introduction

Agricultural production, consisting of farming and ranching, has long been an important component of Pennsylvania's economy. Once a labor-intensive industry, both agricultural production employment and the number of farms have dropped off significantly in recent years due to mechanization and technological improvements in farming. This trend is likely to continue. The decline in farming employment has been most evident among self-employed farmers and unpaid family workers, who make up a significant total of Pennsylvania agricultural employment.

The majority of occupational employment in agricultural production consists of farm managers, farmers and farm workers. Employment of farm managers is projected to increase while the demand for farmers and farm workers will likely decrease as agricultural productivity continues to rise. The South Central portion of the state accounts for over one-fourth of the total farming employment.

The agricultural services sector is composed of several diverse segments that provide services to a wide range of people. Some of these occupations include landscaping and groundskeeping workers, pest controllers, animal caretakers, veterinarians and veterinary assistants.

The training and education requirements for occupations in agricultural services vary as greatly as the occupations themselves. The requirements range from short-term on-the-job training for landscaping and groundskeeping workers to a Doctor of Veterinary Medicine degree needed to become a veterinarian.

Forestry, logging, conservation, and power plant/water treatment occupations comprise the natural resources portion of this publication. With the exception of plant and treatment operators, workers in these occupations are primarily located in the northern sections of Pennsylvania. These occupations generally require no training beyond high school.

Agriculture & Natural Resources Occupations

The occupations in green are either new to this edition or have had a name change since the last.

Agricultural & Food Scientists

Material Moving Equipment Operators

Conservation Scientists & Foresters

Pest Controllers

Farmers, Ranchers & Agricultural Managers

Powerplant Operators, Distributors & Dispatchers

Forestry, Conservation & Logging Occupations

Stationary Engineers & Boiler Operators

Handlers, Equipment Cleaners, Helpers & Laborers

Veterinarians

Inspectors & Compliance Officers

Veterinary Assistants & Non-farm Animal Caretakers

Landscape Architects

Veterinary Technologists & Technicians

Landscaping, Groundskeeping, Nursery, Greenhouse & Lawn Service Occupations

Water & Liquid Waste Treatment Plant & Systems Operators

Auxiliary aids and services are available upon request to individuals with disabilities.
Equal Opportunity Employer/Program

Contact the Center for Workforce Information & Analysis for alternate formats at workforceinfo@state.pa.us, (717) 787-6466 or toll-free at 1-877-493-3282.

Agricultural & Food Scientists

SOC CODE: 19-1011, 19-1012 and 19-1013

Significant Points

- Opportunities will be best for those with advanced degrees.
- A bachelor's degree may be sufficient for positions in applied research.
- About 23 percent were self-employed.

Nature of the Work

- Agricultural and food scientists study farm crops and animals and develop ways to improve their quantity and quality. They use principles of biology, chemistry, physics, and mathematics to solve problems in agriculture.
- Many agricultural scientists work in basic or applied research and development. Some manage marketing or production operations in companies that produce food or agricultural products. Others are consultants to business firms, private clients, or the government.
- Duties of agricultural and food scientists vary depending on the area of specialization.

Food scientists and technologists help meet consumer demand for food products that are healthful, safe, palatable, and convenient. They also develop ways to process, preserve, and package food according to industry and government regulations.

Plant scientists study plants and their growth in soils to assist producers of food, feed, and fiber crop in feeding a growing population while maintaining the environment. Entomologists conduct research to develop new technologies to control or eliminate pests in infested areas and prevent the spread of harmful pests to new areas.

Soil scientists study the composition of soils as they relate to plant or crop growth. They provide information and recommendations regarding the best use of land and plant growth.

Animal scientists work to develop better, more efficient ways of producing and processing meat, poultry, eggs, and milk. Dairy scientists, poultry scientists, and animal breeders study the genetics, nutrition, reproduction, growth, and development of domestic farm animals.

Working Conditions

- Agricultural and food scientists involved in management or basic research tend to work regular hours in offices and laboratories. However, the working environment for those engaged in applied research or product development will vary with the discipline and type of employer.
- Many agricultural and food scientists spend time outdoors conducting research.

Employment

- Agricultural and food scientists held about 30,200 jobs in 2004 in the United States and approximately 560 jobs in Pennsylvania.
- About one-quarter were self-employed. About 18 percent worked for government agencies. Another 17 percent worked for scientific research and development firms.
- The following table includes the industries that employed the most agricultural and food scientists in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Self-Employed	130	22.7%
Federal, State & Local Government	100	18.0%
Scientific Research & Development Services	100	17.0%

Job Outlook

- Employment of agricultural and food scientists in Pennsylvania is expected to grow from 560 in 2004 to 600 in 2014. Agricultural and food scientists can expect about 4 openings due to growth and about 10 replacement openings for approximately 14 total annual openings.

- Agricultural and food scientists will be needed to balance increased agricultural output with soil, water and ecosystem protection and preservation. An increasing focus on diet, health and food safety will result in many job opportunities for food scientists and technologists.
- Graduates with advanced degrees will be in the best position to enter jobs as agricultural and food scientists. However, competition may be keen for some basic research positions.

Earnings

- The following table includes the average hourly, entry level and experienced level wages in 2005 for different agricultural and food scientists in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Animal Scientists	N/A	N/A	N/A
Food Scientists & Technologists	\$57,620	\$29,930	\$71,470
Soil & Plant Scientists	\$48,520	\$31,780	\$56,890

- No Pennsylvania-specific information was available for animal scientists. However, the average salary nationwide for animal scientists in 2005 was \$47,600.

Training, Other Qualifications and Advancement

Training requirements for agricultural and food scientist positions depend on their specialty. A bachelor's degree in agricultural science is sufficient for some jobs in applied research or product development but a master's or doctoral degree is required for basic research jobs. A Ph.D. in agricultural science is usually needed for advancement to administrative research positions. The Federal government hires bachelor degree holders to work as soil scientists. Graduates with degrees in biology, chemistry, physics or in related engineering specialties may qualify for some agricultural and food science jobs.

Many colleges and universities offer agricultural science programs. However, not every school offers all specialties. A typical undergraduate curriculum includes courses in communications, economics, business, physical and life sciences, and agricultural science. Advanced degree programs include classroom sessions, fieldwork, laboratory research, and a thesis or dissertation based on independent research.

The American Society of Agronomy offers many certification programs. To become certified, applicants must meet certain standards for examination, education, and professional work experience.

Agricultural and food scientists should be able to work independently or as part of a team. They should have strong written and oral communication skills. Most need an understanding of basic business principles as well.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of agricultural and food scientists include biologists, chemists, foresters, conservation scientists, farmers and farm managers, veterinarians, horticulturists, and landscape architects.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Society of Agronomy, 677 S. Segoe Rd., Madison, WI 53711. Internet: <http://www.agronomy.org>
- Institute of Food Technologists, 525 W. Van Buren, Suite 1000, Chicago IL 60607. Internet: <http://www.ift.org>
- Entomological Society of America, 10001 Derekwood Lane, Suite 100, Lanham, MD 20706-4876. Internet: <http://www.entsoc.org>
- The Office of Personnel Management at (912) 757-3000; TDD (912) 744-2299 or consult your telephone directory for a local number. Information is also available from the Internet site: <http://www.usajobs.opm.gov>

Conservation Scientists and Foresters

SOC CODE: 19-1031 and 19-1032

Significant Points

- Employers look for a bachelor's degree in forestry or range management.
- Job opportunities should be best for soil conservationists.
- Seven of every 10 worked for government agencies.

Nature of the Work

- Conservation scientists and foresters manage, develop, use, and help protect forests and rangelands.
Foresters balance the desire to conserve forested ecosystems with the need to use forest resources for recreational or economic purposes. They also supervise the planting and growing of new trees.
Range managers, also called *range conservationists*, *range ecologists*, or *range scientists*, manage, improve, and protect rangelands to maximize their use without damaging the environment. They help ranchers attain optimum livestock production while maintaining soil stability and vegetation. Range managers also plan and implement re-vegetation of disturbed sites.
Soil conservationists provide technical assistance to those concerned with the conservation of soil, water, and related natural resources. They develop programs designed to get the most productive use of land without damaging it.
- Scientists often specialize in one area such as forest resource management, forest economics, urban forestry, or wood technology.

Working Conditions

- Some conservation scientists and foresters work regular hours in offices or labs. Others split their time between fieldwork and office work. Independent consultants and less experienced workers spend the majority of their time overseeing or participating in hands-on work.
- Conservation scientists and foresters work outdoors in all types of weather, sometimes in isolated areas. The work can be physically demanding.
- Foresters may work long hours fighting forest fires. After the forest fire has been extinguished, conservation scientists are often called in to prevent erosion after a forest fire. Conservation scientists also provide emergency help after floods, mudslides, and tropical storms.

Employment

- Conservation scientists and foresters held about 31,800 jobs in 2005 in the United States and approximately 850 jobs in Pennsylvania.
- Over 69 percent were employed in Federal, State and local government agencies. Another 11 percent worked in sawmills. About 1 in 15 were self-employed consultants.

Job Outlook

- Employment of conservation scientists and foresters in Pennsylvania is expected to grow from 850 jobs in 2004 to about 860 jobs in 2014. Conservation scientists and foresters can expect about one opening due to growth and about 24 replacement openings for approximately 25 total annual openings.
- A continuing emphasis on environmental protection and responsible land management will create growth. Job opportunities will be best for soil conservationists.
- Salaried foresters working for private industry and consulting foresters will be needed to provide technical assistance and forest management plans to landowners.

Earnings

- Average annual earnings of conservation scientists in Pennsylvania were \$48,120 in 2005. The entry-level wage in 2005 was \$32,350 while an experienced conservation scientist made \$56,000.
- Average annual earnings of foresters in Pennsylvania were \$53,430 in 2005. The entry-level wage for a forester in 2005 was \$37,470 while an experienced forester made \$61,400.

Training, Other Qualifications and Advancement

A bachelor's degree in forestry is the minimum educational requirement for professional foresters. In the Federal Government, a combination of experience and appropriate education may substitute for a four-year forestry degree, but job competition makes this difficult. Those who wish to perform specialized research or teach should have an advanced degree.

Most colleges and universities offer programs in forestry. Curriculums stress science, mathematics, communications skills, and computer science, as well as technical forestry subjects. Prospective foresters should have a strong grasp on policy issues and on the numerous and complex environmental regulations. Many colleges encourage students to take summer jobs that provide experience in forestry or conservation work.

Some foresters work their way up to managerial positions within their companies. Others become self-employed consulting foresters, working alone or with one or several partners.

A bachelor's degree in range management or range science is usually required for range manager positions. Graduate degrees are usually required for research positions. Range management courses combine plant, animal, and soil sciences with principles of ecology and resource management. Desirable electives include economics, forestry, hydrology, agronomy, wildlife, animal husbandry, and computer science.

Very few colleges and universities offer degrees in soil conservation. Most soil conservationists have degrees in environmental studies, agronomy, general agriculture, hydrology, or crop science. Soil conservationists usually begin working within one district and with experience may advance to the state, regional, or national level. They can also transfer to related occupations such as farm or ranch management advisor or land appraiser.

In addition to meeting the demands of forestry and conservation research and analysis, foresters and conservation scientists must enjoy working outdoors, be physically fit, and be willing to move to where the jobs are. They must work well with people and have good communications skills.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of conservation scientists and foresters include agricultural engineers, environmental engineers, agricultural scientists, biological scientists, environmental scientists, wildlife managers, and farm and ranch managers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Society of American Foresters, 5400 Grosvenor Ln., Bethesda, MD 20814. Internet: <http://www.safnet.org>
- National Association of State Foresters, 444 N. Capitol St. NW, Suite 540, Washington, DC 20001. Internet: <http://www.stateforesters.org>
- Society for Range Management, 445 Union Blvd., Suite 230, Lakewood, CO 80228. Internet: <http://www.rangelands.org>
- USDA Forest Service, 1400 Independence Ave. SW, Washington, DC 20250. Internet: <http://www.fs.fed.us>

Farmers, Ranchers & Agricultural Managers

OES CODES: 11-9011 and 11-9012

Significant Points

- Modern farming requires technical knowledge as well as hands-on work experience.
- Almost three-quarters were self-employed.
- Small-scale farmers have a niche in organic food production and farmer's markets.

Nature of the Work

- Farmers and ranchers may own or rent the land they use. The type of farm being operated determines their specific tasks.
 - Crop farmers* are responsible for planning, tilling, planting, fertilizing, cultivating, spraying, and harvesting. After the harvest, they make sure the crops are properly packaged, stored, or marketed.
 - Livestock, dairy and poultry farmers* must feed, plan, and care for the animals and keep farm buildings clean and in good condition. They may also oversee breeding and marketing activities.
 - Horticultural specialty farmers* oversee the production of ornamental plants, nursery products, and fruits and vegetables grown in greenhouses.
 - Aquaculture farmers* stock, feed and protect aquatic life that is sold for consumption or used for recreational fishing.
- Farm output is strongly influenced by weather, disease, fluctuations in farm product prices, and Federal farm programs. Those who plan ahead may be able to store their crops or keep their livestock in order to take advantage of better prices later in the year.
- Some farmers may have to secure loans from credit agencies to finance the purchase of machinery, fertilizer, livestock, and feed.
- *Agricultural managers* assist farmers and ranchers in maximizing the financial returns to their land by managing the day-to-day activities. They may oversee a single activity, such as feeding livestock, for the owner of a very large livestock farm or they may assume responsibility for all functions when managing a small farm.

Working Conditions

- Farming is strenuous, the work hours are long, and the days off are rare, especially during planting, growing, and harvesting seasons. For many, these disadvantages are outweighed by the opportunities to live in a rural area, work outdoors, and be self-employed.
- Farm work can be hazardous. The proper operation of equipment and handling of chemicals is necessary to avoid accidents and protect the environment.
- Livestock farmers must work throughout the year. Animals must be fed and watered every day and dairy cows must be milked two or three times a day. Such farmers rarely get time off unless they hire an assistant or arrange for a temporary substitute.
- Farming operations have become more complex in recent years and many farmers, ranchers, and agricultural managers are using computers to electronically manage many aspects of their businesses.

Employment

- Farmers, ranchers & agricultural managers held about 1.3 million jobs in 2004 in the United States and approximately 44,340 jobs in Pennsylvania.
- About 75 percent were self-employed. Others worked on or managed farms owned by other people.
- The soil, topography and climate of the area generally determine the type of farming done.

Job Outlook

- Employment of farmers, ranchers & agricultural managers in Pennsylvania is expected to grow from approximately 44,340 in 2004 to approximately 45,630 in 2014. These workers can expect about 129 openings due to growth and about 389 replacement openings for approximately 518 total annual openings.
- Market pressures will continue the trend toward farm consolidation, further reducing the number of jobs for farmers and farm managers. However, job openings will result from the need to replace those who retire or leave the occupation for economic reasons.

- Many small-scale farmers have developed opportunities in organic food production and farmers' markets.
- Over-fishing has resulted in declining ocean catches, and the growing demand for shrimp, salmon, and catfish will continue to spur the growth of aquaculture farms.

Earnings

- Average annual earnings of farmers and ranchers in Pennsylvania were \$41,530 in 2005. The entry-level rate for a farmer in 2005 was \$24,000 while an experienced farmer made \$50,300.
- No Pennsylvania-specific information was available for farm, ranch and other agricultural managers. However, the average salary nationwide for farm, ranch and other agricultural managers in 2005 was \$55,760.
- Farmers' incomes vary greatly from year to year because the price of farm products fluctuate as does the demand for those products. Many farmers, especially small-scale farmers, have income from off-farm business activities. This income is often greater than that of their farm income.

Training, Other Qualifications and Advancement

Growing up on a family farm and participating in agricultural programs are important sources of training for aspiring farmers, ranchers, and agricultural managers. However, modern farming requires complex scientific, business, and financial decisions. Therefore, farmers must acquire the appropriate technical knowledge of crops, growing conditions, plant diseases, and veterinary science to make decisions to ensure the successful operation of their farms.

Agricultural managers often obtain a bachelor's degree in business with a concentration in agriculture. Common programs of study include agronomy, dairy science, agricultural business, horticulture, crop and fruit science, and animal science. Formal programs in aquaculture are available and include coursework in fisheries biology, fish culture, hatchery management, and hydrology. In addition to formal education, agricultural managers should have several years of work experience in the different aspects of farm operations.

Farmers, ranchers, and agricultural managers need a basic knowledge of accounting and bookkeeping. They must be familiar with complex safety regulations and government requirements. Mechanical aptitude and the ability to work with various tools are valuable skills. As farming operations become more complex, computer skills are increasingly important.

The American Society of Farm Managers and Rural Appraisers can enhance professional status through voluntary certification as an Accredited Farm Manager (AFM). Certification requires several years of farm management experience, the appropriate academic background, and passing of courses and examinations relating to business, financial, and legal aspects of farm management.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of farmers, ranchers, and agricultural managers include agricultural engineers, agricultural and food scientists, agricultural workers, and purchasing agents of farm products.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Center for Rural Affairs, 145 Main St., PO Box 136, Lyons, NE 68038. Internet: <http://www.cfra.org>
- American Society of Farm Managers and Rural Appraisers, 950 S. Cherry St., Suite 508, Denver, CO 80246. Internet: <http://www.asfmra.org/>
- Small Farm Program, USDA, Cooperative State, Research, Education, and Extension Service, Stop 2215, Washington, DC 20250-2215. Internet: <http://www.usda.gov/oce/smallfarm/>
- Alternative Farming System Information Center (AFSIC), National Agricultural Library USDA, 10301 Baltimore Ave., Room 132, Beltsville, MD 20705-2351. Internet: <http://www.nalusda.gov/afsic>
- Appropriate Technology Transfer for Rural Areas (ATTRA), National Sustainable Agriculture Service, PO Box 3657, Fayetteville, AR 72702. Internet: <http://www.attra.ncat.org>

Forestry, Conservation & Logging Occupations

SOC CODES: 19-4093, 45-4011, 45-4021, 45-4022 and 45-4023

Significant Points

- Increased mechanization and improved equipment will reduce the demand for these workers.
- These jobs are physically demanding and can be hazardous.
- About 1 in 5 were self-employed.

Nature of the Work

- Forest and conservation workers help develop, maintain, and protect forests. They plant new tree seedlings, fight insects, or diseases that attack trees and help to control soil erosion.
Forest workers reforest and conserve timberlands and maintain forest facilities, such as roads and campsites.
A forestry technician compiles data on the forestland. They may train forest and conservation workers.
- Workers in forest nurseries sort out tree seedlings and discard any that do not meet prescribed standards while those working on tree farms plant, cultivate, and harvest many different kinds of trees.
- Logging workers harvest forests for the timber that provides the raw material for countless consumer and industrial products. A logging crew of four to eight workers carries out the logging and timber cutting process.
Fallers cut down the trees and *bucks* trim off the tops and branches and cut the logs into specified lengths.
Choke setters fasten steel cables or chains around the cut logs so they may be dragged by tractor or forwarded by the cable yarding system to the landing area where they are separated and loaded onto trucks.
Rigging slingers and chasers set up and dismantle the cables and guy wires of the cable yarding system.
Log sorters, markers, movers, and de-barkers sort, mark, and move logs, based on species, size, and ownership. They also tend the machines that de-bark the logs.
Logging equipment operators drive tractors that transport logs to the landing area, operate grapple loaders that load logs into trucks, and use tree harvesters to shear and limb trees and cut the logs into desired lengths.
Log graders and scalers inspect logs for defects, measure logs to determine their volume, and estimate the marketable value of the logs or pulpwood.

Working Conditions

- Forestry, conservation & logging workers spend a majority of their time outdoors, sometimes in poor weather and often in isolated areas.
- Although equipment has greatly improved and logging and timber cutting operations are becoming increasingly mechanized, many logging jobs are still labor intensive.
- Logging work can be extremely hazardous if safety precautions are not taken. Use of proper safety measures and equipment is important in order to avoid injury. The jobs of forest and conservation workers are generally much less hazardous.

Employment

- Forestry, conservation & logging workers held about 117,100 jobs in 2004 in the United States and approximately 2,220 jobs in Pennsylvania.
- Almost 20 percent worked for sawmill and wood preservation firms. About 1 in 5 were self-employed. Others work for logging companies and government agencies.
- The following table includes the industries that employed the most forestry, conservation & logging workers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Sawmills & Wood Preservation	430	19.4%
Self-Employed	420	19.1%
Logging	410	18.6%
State Government	410	18.5%

Job Outlook

- Employment of forestry, conservation & logging workers in Pennsylvania is expected to grow from approximately 2,220 in 2004 to approximately 2,300 in 2014. These workers can expect about 8 openings due to growth and about 46 replacement openings for approximately 54 total annual openings.
- Despite a steady demand for lumber and other wood products, increased mechanization and improved equipment will reduce the demand for workers. However, opportunities will exist because many workers are not committed to the occupation on a long-term basis.
- Environmental concerns may spur the demand for forest and conservation workers who maintain and conserve our woodlands, however budgetary constraints may suppress this growth.
- Weather and construction levels often impact forestry, conservation & logging workers. Prolonged periods of inactivity can occur and some workers may find themselves without work. In addition, relocation may be necessary once a particular area has been completely harvested of lumber.

Earnings

- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different forestry, conservation & logging occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Fallers	\$11.96	\$10.08	\$12.90
Forest & Conservation Technicians	N/A	N/A	N/A
Forest & Conservation Workers	N/A	N/A	N/A
Log Graders & Scalers	\$12.17	\$9.04	\$13.73
Logging Equipment Operators	\$11.52	\$7.80	\$13.38

- No Pennsylvania-specific wage information was available for forest & conservation technicians. However, the average hourly wage nationwide for forest & conservation technicians in 2005 was \$15.13.
- No Pennsylvania-specific wage information was available for forestry & conservation workers. However, the average hourly wage nationwide for forestry & conservation workers in 2005 was \$11.19.

Training, Other Qualifications and Advancement

Most forestry, conservation & logging occupations require no formal education beyond high school. Skills are usually developed through on-the-job training with instruction from experienced workers. However, vocational-technical schools and some community colleges do offer a two-year degree in general forestry, wildlife, conservation, and forest harvesting, which could be helpful in obtaining a job. Experience in occupations with related duties, such as nursery worker, truck driver, or crane operator, could expedite entry into forestry, conservation & logging occupations.

Some large logging companies and trade associations, such as the Northeastern Loggers Association and the American Pulpwood Association, offer formal training programs. Many forestry or logging associations provide special training sessions for fallers, whose job duties require more skill and experience than other positions on the logging team. Sessions often take place in the field, so trainees have the opportunity to practice. Safety training is a vital part of instruction for all logging workers.

Forestry, conservation & logging workers must be in good health, have physical stamina, and be able to work as part of a team. Maturity and good judgment are important traits when dealing with hazardous situations. Mechanical aptitude and coordination are necessary qualities for operators of machinery and equipment. Initiative and business skills are necessary for the self-employed.

Workers generally advance from occupations involving primarily manual labor to those involving the operation of complicated machinery and equipment. Those who have the motor skills required for the efficient use of power saws and other equipment may become fallers and buckers.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of forestry, conservation &

logging workers include conservation scientists and foresters, forest and conservation technicians, ground maintenance workers, and material moving equipment operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Forest Resources Association, Inc., 600 Jefferson Plaza, Suite 350, Rockville, MD 20852.
Internet: <http://www.forestresources.org>
- Northeastern Loggers Association, P.O Box 69, 3311 St. Rte. 28, Old Forge, NY 13420.
Internet: <http://www.loggertraining.com>
- American Forest and Paper Association, 1111 19th St. NW, Suite 800, Washington, DC 20036.
Internet: <http://www.afandpa.org>

Handlers, Equipment Cleaners, Helpers & Laborers

SOC CODES: 47-2061, 47-3011, 47-3012, 47-3013, 47-3014, 47-3015, 47-3016, 47-5081, 49-9098, 51-9198, 53-6021, 53-6031, 53-7061, 53-7062, 53-7063, 53-7064 and 53-7081

Significant Points

- Most jobs are entry-level and require no formal training.
- Projected employment growth varies by occupation.

Nature of the Work

- Handlers, equipment cleaners, helpers, and laborers (called general laborers going forward) perform tasks that are needed to make the work of skilled construction, maintenance, and production workers flow smoothly.
- To perform their jobs effectively, general laborers must be familiar with the work of those they are assisting.

Construction craft laborers provide much of the physically demanding labor at construction sites. They may prepare sites, dig trenches, mix concrete, or set explosives.

Freight, stock, and material movers use forklifts, dollies, carts, and manual power to move materials between storage and production areas.

Hand packers and packagers manually pack, package, or wrap a variety of materials. They may inspect items, label cartons, and stack packages.

Helpers assist skilled workers. They may fetch tools, hold materials, or clean work areas.

Machine feeders and offbearers are responsible for feeding or removing materials from machines.

Parking lot attendants assist customers in parking their cars and collect parking fees.

Refuse and recyclable material collectors gather trash, garbage, and recyclables from homes and businesses along a regularly scheduled route. They also transport the refuse to the dump, landfill, or recycling center.

Service station attendants fill fuel tanks and wash windshields on vehicles. They may perform simple repairs under the direction of a mechanic.

Vehicle washers and equipment cleaners use water and various cleaning equipment to maintain machinery, vehicles, storage tanks, pipelines, and similar equipment.

Working Conditions

- Although work schedules vary with industry, most general laborers work 8-hour shifts. Early morning, evening, and “graveyard” shifts are common.
- General laborers do repetitive, physically demanding work. They may work at great heights or in tight, awkward places. Some laborers work outdoors in all weather conditions.
- These employees wear safety clothing and hard hats to avoid against injury. Because they may be exposed to harmful materials or chemicals, some workers wear protective devices over their eyes, mouth, and ears.

Employment

- General laborers held about 6.2 million jobs in 2004 in the United States and approximately 253,580 jobs in Pennsylvania.
- Nearly one-quarter worked for manufacturing companies. About 18 percent were employed in the construction industry and roughly 17 percent in service-providing establishments.
- The following table includes the industry groups that employed the most general laborers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	60,170	23.7%
Construction	44,660	17.6%
Services	41,910	16.5%
Retail Trade	36,600	14.4%
Transportation & Warehousing	27,800	11.0%

Job Outlook

- Employment of general laborers in Pennsylvania is expected to decrease from approximately 253,580 in 2004 to approximately 252,670 in 2014. About 7,425 annual openings will result from replacement needs. Although no net employment growth is expected for general laborers, growth openings may occur in some specific occupations and certain regions.
- Equipment cleaners, hand packers, parking lot attendants, construction helpers, and refuse material collectors will have the best employment prospects. Service station attendants and machine feeders can expect declines in employment levels.
- Employment growth will be limited by automation, out-sourcing, and job combination. All of these factors increase productivity and improve quality control. As a result, many jobs will be eliminated.

Earnings

- In Pennsylvania, general laborers averaged \$8.30 to \$15.10 per hour in 2005. Entry-level rates were between \$6.00 and \$9.40 per hour, while experienced laborers earned anywhere from \$9.40 to \$18.00 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for general laborers in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Construction Laborers	\$15.06	\$9.36	\$17.91
Helpers--Brick, Block & Stonemasons and Tile & Marble Setters	\$13.33	\$9.11	\$15.44
Helpers--Carpenters	\$10.93	\$8.29	\$12.25
Helpers--Electricians	\$12.52	\$8.08	\$14.74
Helpers--Painters, Paperhangers, Plasterers & Stucco Masons	\$11.30	\$7.61	\$13.15
Helpers--Pipelayers, Plumbers, Pipefitters & Steamfitters	\$12.00	\$8.71	\$13.65
Helpers--Roofers	\$10.85	\$7.88	\$12.34
Helpers--Extraction Workers	\$13.02	\$8.59	\$15.23
Helpers--Installation, Maintenance & Repair Workers	\$11.29	\$7.36	\$13.26
Helpers--Production Workers	\$11.40	\$7.74	\$13.23
Parking Lot Attendants	\$8.34	\$6.19	\$9.42
Service Station Attendants	\$8.32	\$6.00	\$9.48
Cleaners of Vehicles & Equipment	\$8.92	\$6.32	\$10.22
Laborers & Freight, Stock & Material Movers, Hand	\$11.61	\$7.65	\$13.59
Machine Feeders & Offbearers	\$12.07	\$8.29	\$13.97
Packers & Packagers, Hand	\$10.10	\$6.99	\$11.65
Refuse & Recyclable Material Collectors	\$13.82	\$8.63	\$16.41

Training, Other Qualifications and Advancement

Most general laborer positions are entry-level and do not require a high school diploma or any previous experience. However, most employers prefer to hire those who are at least 18 years old and physically able to perform the work. Applicants may have to take a physical exam, pass a drug test, or undergo a background check prior to employment.

Workers must be reliable and hard working. Basic reading and math skills are needed to understand procedure manuals and collect payments from customers. Grocery store baggers, service station workers, and parking lot attendants should be pleasant and courteous when dealing with the public.

Although most general laborers learn their skills through on-the-job training, formal apprenticeship programs are available in construction trades. These programs, which combine on-the-job training with classroom instruction, provide overall preparation. Apprentices are taught how to properly handle all tools and equipment.

Before an apprentice is placed on the job, most union contractors require some hands-on training. Likewise, workers who must handle toxic chemicals or operate dangerous equipment often receive additional training in safety awareness and procedures.

Experienced laborers often become trainees for skilled construction, maintenance, and production positions. In fact, most employers prefer to fill open slots with qualified workers from within the company. Some general laborers are promoted to supervisory positions.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of general laborers include roustabouts, forest workers, logging equipment operators, and groundskeepers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Carwash Association, 401 N. Michigan Ave., Chicago, IL 60611.
Internet: <http://www.carwashes.com>

Inspectors & Compliance Officers

SOC CODES: 13-1041, 13-2061, 17-2111, 19-2041, 29-9011, 29-9012, 45-2011 and 53-6051

Significant Points

- Because job functions are so diverse, entry-level occupational requirements vary widely.
- Most worked for government agencies.

Nature of the Work

- Inspectors and compliance officers are responsible for keeping work environments safe, food healthy, and the environment clean. The duties performed will vary with area of responsibility and level of experience.
 - Aviation safety inspectors* work for the Federal Aviation Administration (FAA) and oversee the avionics, maintenance, and operations of air carrier establishments.
 - Bank examiners* investigate financial institutions and their compliance with Federal or State regulations that govern the institution's operation and solvency.
 - Consumer safety officers* inspect food, feeds, pesticides, biological products, cosmetics, drugs, medical equipment, and radiation emitting products.
 - Environmental health inspectors* analyze substances in order to determine contamination or the presence of disease. They ensure that the quality of food, water, and air meets government standards.
 - Equal opportunity specialists* enforce laws and regulations that prohibit discrimination in employment and the provision of services on the basis of race, color, national origin, religion, sex, disability, and age.
 - Food Inspectors* ensure that food products are fit for human consumption and in compliance with Federal laws. Processing food inspectors specialize in processed ingredients that are contained in the final product.
 - Mine safety and health inspectors* conduct on-site inspections of mines, mills, and quarries in search of conditions that are potentially hazardous to the safety and health of workers.
 - Occupational Safety and Health Administration (OSHA) inspectors* serve as expert consultants on the application of safety principles, practices, and techniques in the workplace.
 - Park rangers* enforce laws and regulations in State and national parks.
 - Securities compliance examiners* implement regulations concerning securities and real estate transactions.
- Other inspectors and compliance officers include attendance officers, logging operations inspectors, coroners, travel accommodations raters, code inspectors, mortician investigators, and dealer-compliance representatives.

Working Conditions

- Many inspectors and compliance officers work long, irregular hours. Considerable fieldwork and frequent travel may be required. Workers are usually reimbursed for their travel expenses.
- Working environments may be unpleasant, stressful or dangerous. For example, food inspectors may work near machinery or in confined areas with livestock. Park rangers often work outdoors in rugged terrain and extreme temperature differences.
- Inspectors may find themselves in an adversarial role when the organization or individual being inspected objects to the process or its consequences.

Employment

- Inspectors and compliance officers held about 391,500 jobs in 2004 in the United States and approximately 14,080 jobs in Pennsylvania.
- About 44 percent were employed with Federal, state and local government agencies. Another 27 percent worked for service-providing companies.
- The following table includes the industry groups that employed the most inspectors and compliance officers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Government	6,150	43.7%
Services	3,830	27.2%
Finance & Insurance	1,640	11.6%
Manufacturing	1,160	8.2%

Job Outlook

- Employment of inspectors and compliance officers in Pennsylvania is expected to grow from approximately 14,080 in 2004 to approximately 15,010 in 2014. Inspectors and compliance officers can expect about 93 openings due to growth and about 323 replacement openings for approximately 416 total annual openings.
- Employment growth will be relatively steady as the public demand for a safe environment and quality products offsets the desire to limit government regulations.
- General economic fluctuations seldom affect employment growth. Government agencies, which employ the most inspectors and compliance officers, provide considerable job security.

Earnings

- In Pennsylvania, inspectors and compliance officers averaged \$43,000 to \$70,000 annually in 2005. Entry-level workers earned between \$19,000 and \$47,000, while experienced inspectors and compliance officers were paid anywhere from \$48,000 to \$84,000.
- Financial examiners earned the highest average annual and experienced level wages, while entry-level wages were greatest for health and safety engineers. Occupational health and safety technicians had the lowest average annual and entry-level wages.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for inspectors and compliance officers in Pennsylvania.

Occupational Title	Average Annual Wage	Entry Level Wage	Experienced Level Wage
Compliance Officers	\$50,080	\$31,320	\$59,450
Financial Examiners	\$69,050	\$39,940	\$83,610
Health & Safety Engineers	\$64,880	\$46,250	\$74,190
Environmental Scientists & Specialists	\$59,330	\$33,540	\$72,220
Occupational Health & Safety Specialists	\$53,930	\$32,640	\$64,570
Occupational Health & Safety Technicians	\$43,310	\$19,640	\$55,140
Agricultural Inspectors	\$44,100	\$34,330	\$48,990
Transportation Inspectors	\$52,030	\$22,330	\$66,880

Training, Other Qualifications and Advancement

Because job functions are so diverse, the occupational requirements for inspector and compliance officer positions vary widely. However, some combination of education, experience, and passing examination scores is usually required. Many employers prefer a college degree and previous experience in the area being investigated.

Position-specific laws and procedures are usually taught through on-the-job training and classroom instruction. In addition, certain positions require special licenses and certifications. For example, aviation safety inspectors must possess a valid pilot's license.

Aspiring inspectors and compliance officers should be responsible people who like detailed work. Strong communication skills are very important. For certain positions, applicants may have to meet strict medical requirements and be able to perform arduous duties efficiently.

Inspectors and compliance officers with satisfactory job performance often advance through a career ladder to a specified full-performance level. For positions above this level, advancement becomes competitive. Appointments are made based on agency needs and the individual's merit.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of inspectors and compliance officers include construction inspectors, building inspectors, fish and game wardens, fire marshals, law enforcement professionals, and correctional officers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>

Landscape Architects

SOC CODE: 17-1012

Significant Points

- Employers prefer to hire applicants with internship experience.
- About one-fifth were self-employed.

Nature of the Work

- *Landscape architects* design residential areas, public parks, and shopping centers so that they are not only functional but beautiful and compatible with the environment as well. They help determine the best arrangement of roads and buildings and find ways to conserve or restore natural resources.
- Computer-aided design (CAD) and video simulation have become essential tools in preparing designs. For larger scale projects, geographic information systems technology is often used.
- Once the design is complete, a detailed plan, including written reports, sketches, models, photographs, land-use studies, and cost estimates, is submitted for approval by the client and by regulatory agencies.
- Some landscape architects work on a variety of projects while others specialize in one area. Few limit their practice to residential landscape design projects because they are usually too small to provide suitable income.
- Landscape architects who work for government agencies work on government buildings, parks, and other public lands. In addition, they may prepare environmental impact statements and studies on environmental issues such as public land-use planning. Some also restore degraded land, such as mines or landfills.

Working Conditions

- Salaried employees work a standard 40-hour week. At times, a project deadline may require longer work hours.
- Landscape architects spend most of their time in offices creating designs, preparing models and cost estimates, doing research, and attending meetings with clients and other professionals involved in the project.
- Significant time is spent visiting and analyzing the site to verify that the design can be incorporated into the landscape. Additional time may be spent observing or supervising the construction.

Employment

- Landscape architects held about 24,800 jobs in 2004 in the United States and approximately 610 jobs in Pennsylvania.
- Over 42 percent worked for architectural & engineering consulting firms. About 1 in 5 were self-employed.
- The following table includes the industries that employed the most landscape architects in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Architectural & Engineering Services	260	42.5%
Services to Buildings and Dwellings	140	23.1%
Self-Employed	110	18.0%

Job Outlook

- Employment of landscape architects in Pennsylvania is expected to grow from approximately 610 in 2004 to approximately 670 in 2014. Landscape architects can expect about 6 openings due to growth and about 7 replacement openings for approximately 13 total annual openings.
- Increased development of open space as well as historic preservation, land reclamation, and refurbishment of existing sites will create demand for landscape architects.
- Opportunities vary from year to year and by geographic region, depending on local economic conditions. Landscape architects who develop strong technical and communication skills and knowledge of environmental codes and regulations will have the advantage.
- Budget tightening may restrict hiring. Because they can work on many different types of projects, landscape architects may have an easier time than other design professionals finding alternate employment.

Earnings

- Average annual earnings of landscape architects in Pennsylvania were \$50,820 in 2005. The entry-level wage for a landscape architect in 2005 was \$29,220 while an experienced landscape architect made \$61,620.
- Because they work for smaller firms or are self-employed, landscape architects tend to have less generous benefits than those provided to workers in larger organizations.

Training, Other Qualifications and Advancement

A bachelor's or master's degree in landscape architecture is usually necessary for entry-level positions. In addition, many employers prefer to hire those with previous experience, which significantly reduces the amount of on-the-job training required.

The bachelor's degree program in landscape architecture takes four or five years to complete. Graduates can then enter one of two types of accredited master's degree programs. The most common program, which offers a master's degree as a first professional degree, is a three-year program designed for students with an undergraduate degree in another discipline. The other program, which offers a master's degree as the second professional degree, is a two-year program designed for students with a bachelor's degree in landscape architecture that wish to teach or specialize in some aspect of landscape architecture.

Required college courses usually include surveying, landscape ecology, site design, urban and regional planning, history of landscape architecture, plant and soil science, geology, and general management. Many programs are adding courses that address environmental issues as well. Whenever possible, students are assigned real projects which provide them with valuable hands-on experience and the opportunity to become more proficient in the use of computer-aided design, geographic information systems, and video simulation.

Pennsylvania requires all landscape architects to be licensed or registered. Licensing is based on the Landscape Architect Registration Examination (L.A.R.E.), which is sponsored by the Council of Landscape Architectural Registration Boards. Admission to the exam requires a degree from an accredited school plus 1 to 4 years of work experience. Passing the L.A.R.E. allows landscape architects to work in other states. The Federal Government does not require its landscape architects to be licensed.

Those planning a career in landscape architecture should appreciate nature, enjoy working with their hands, and possess strong analytical skills. Creative vision and artistic talent are also desirable qualities. Good oral and written communication skills are essential to landscape architects who must be able to convey their ideas to other professionals and clients. Knowledge of computer applications, including word-processing, desktop publishing, and spreadsheets, is also valuable.

After gaining experience, landscape architects may advance to jobs such as construction supervisors, land or environmental planners, or landscape consultants. Many choose to open their own business because of relatively low start-up costs. Even with self-discipline, business insight, and good marketing skills, some self-employed landscape architects struggle while building a client base.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of landscape architects include architects, surveyors, civil engineers, conservationist scientists, urban and regional planners, foresters, geoscientists, and environmental scientists.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Society of Landscape Architects, Career Information, 636 Eye Street, NW, Washington, DC 20001-3736. Internet: <http://www.asla.org>
- Council of Landscape Architectural Registration Boards, 144 Church St. NW, Suite 201, Vienna, VA 22180. Internet: <http://www.clarb.org>

Landscaping, Groundskeeping, Nursery, Greenhouse and Lawn Service Occupations

SOC CODES: 37-1012, 37-3011, 37-3012, 37-3013 and 45-2092

Significant Points

- Most learn their trade through short-term on-the-job training.
- Opportunities will exist due to growth and significant turnover.
- Many gardeners and groundskeepers work with little direct supervision.

Nature of the Work

- Workers in landscaping, groundskeeping, nursery, greenhouse and lawn service occupations (commonly referred to as grounds maintenance and nursery workers) are responsible for the variety of tasks necessary to achieve a pleasant and functional outdoor environment. They also care for indoor gardens and plantings in commercial and public facilities.

Nursery and greenhouse workers help to cultivate the plants, trees, and shrubs used to beautify landscapes.

Nursery and greenhouse managers determine which plants will be grown, purchase products, hire workers, and manage business activities.

Landscape contractors coordinate and oversee the implementation of designs developed by a landscape architect. They must determine the labor, equipment, and materials that will be needed to complete a project.

Landscaping laborers install and maintain landscaped areas. They transport and plant new vegetation; transplant, mulch, fertilize, water, and prune flowering plants, trees, and shrubs; and mow and water lawns.

Lawn service workers provide full-service landscape maintenance. They mow, edge, trim, fertilize, mulch, and de-thatch lawns and shrubs.

Lawn service managers are responsible for negotiating fees and scheduling jobs as well as hiring and training new employees.

Groundskeeping laborers, also called groundskeepers or grounds maintenance personnel, see to the proper upkeep and repair of sidewalks, parking lots, pools, fountains, fences, planters, benches, and groundskeeping equipment at a variety of facilities.

Grounds managers may participate in many of the same tasks as maintenance personnel but also have supervisory responsibilities. They must train personnel, draw up contracts, allocate resources, and engage in public relations activities.

- Landscaping, groundskeeping and lawn service workers use hand tools such as shovels, rakes, pruning saws, hedge and brush trimmers, and axes. They also use power lawnmowers, chain saws, snow blowers, and electric clippers. Some use tractors and twin-axle vehicles.
- Landscape contractors and those in managerial positions use computers to develop design plans and blueprints, estimate and track project costs, and maintain payroll and personnel information.

Working Conditions

- Many grounds maintenance and nursery employees work part-time. These jobs are common among students.
- Grounds maintenance and nursery jobs are usually seasonal. Most occur in the spring, summer, and fall months when planting, mowing, trimming, and cleanup are necessary.
- Most time is spent outdoors. Work can be physically demanding and repetitive. Workers may be under pressure to complete a job.
- Those who work with pesticides, fertilizers, power lawnmowers, chain saws, and power clippers must exercise safety precautions.

Employment

- Grounds maintenance and nursery workers held about 2.1 million jobs in 2004 in the United States and approximately 77,820 jobs in Pennsylvania.
- About 35 percent worked on animal or crop production farms. Another 24 percent were employed by organizations offering landscaping and horticultural services. About 1 in 10 were self-employed.
- The following table includes the industries that employed the most grounds maintenance and nursery workers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Services to Buildings & Dwellings	18,600	23.9%
Animal Production	14,300	18.4%
Crop Production	12,730	16.4%
Self-Employed	8,040	10.3%

Job Outlook

- Employment of grounds maintenance and nursery workers in Pennsylvania is expected to grow from approximately 77,820 in 2004 to approximately 84,220 in 2014. These workers can expect about 640 openings due to growth and about 1,835 replacement openings for approximately 2,475 total annual openings.
- Individuals interested in grounds maintenance and nursery occupations should find excellent job opportunities in the future. Low entry-level wages and physically demanding work create many job openings that employers cannot fill.
- Construction of new commercial and industrial buildings, shopping malls, homes, highways, and recreational facilities, as well as the upkeep and renovation of existing landscapes, will create demand for these workers.
- Nursery and greenhouse laborers and managers will be needed as the popularity of home gardening continues. They will also be needed to cultivate and provide the vegetation used by landscaping services.

Earnings

- In Pennsylvania, grounds maintenance and nursery workers average \$9.80 to \$19.60 hourly in 2005. Entry-level rates were between \$6.80 and \$11.90, while experienced grounds maintenance and nursery workers earned anywhere from \$11.30 to \$23.50 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different grounds maintenance and nursery occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Supervisors - Landscaping & Groundskeeping Workers	\$19.59	\$11.85	\$23.45
Landscaping & Groundskeeping Workers	\$10.72	\$7.22	\$12.46
Pesticide Handlers, Sprayers & Applicators, Vegetation	\$13.92	\$10.74	\$15.51
Tree Trimmers & Pruners	\$13.28	\$10.36	\$14.74
Farmworkers & Laborers: Crop, Nursery & Greenhouse	\$9.84	\$6.85	\$11.34

Training, Other Qualifications and Advancement

Entry-level grounds maintenance and nursery laborer positions usually have no minimum educational requirements. Short-term on-the-job training is sufficient to teach new hires how to operate equipment and follow correct safety procedures.

Grounds maintenance and nursery workers must be able to follow directions and learn proper planting procedures. They must be responsible, self-motivated, and able to work with little supervision. Those who deal directly with customers must have good people skills. A good driving record and previous experience driving a truck may be important if driving is an essential part of a job.

Grounds managers or landscape contractors should be knowledgeable about turf care, horticulture, ornamental plants, and irrigation techniques. Several years of hands-on experience plus formal education in grounds management or landscape design provides a strong background. Some schools even offer cooperative education programs in which students work alternate semesters or quarters for a lawn care or landscape contractor.

Laborers who demonstrate a willingness to work hard and have good communication skills may advance to crew leader or other supervisory positions. Advancement or entry into positions as grounds manager or landscape contractor usually requires some formal education beyond high school and several years experience. Some workers open their own business.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of grounds maintenance and nursery workers include construction workers, landscape architects, farmers, horticultural workers, tree forest conservation workers, and soil conservation technicians.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Professional Land Care Network, 950 Herrndon Parkway, Suite 450, Herrndon, VA, 20170. Internet: <http://landcarenetwork.org>
- Professional Grounds Management Society, 720 Light St., Baltimore, MD 21230. Internet: <http://www.pgms.org>
- Tree Care Industry Association, 3 Perimeter Rd., Unit I, Manchester, NH 03103. Internet: <http://www.tcia.org>

Material Moving Equipment Operators

SOC CODES: 53-7011, 53-7021, 53-7031, 53-7032, 53-7033, 53-7041, 53-7051, 53-7071, 53-7072, 53-7073, 53-7111 and 53-7121

Significant Points

- Necessary skills are acquired through on-the-job training programs.
- Job growth will depend on the employing industry.

Nature of the Work

- Material moving equipment operators use machinery to move construction materials, earth, petroleum products, and other heavy materials. They may also load or unload trucks, ships, and railroad cars.
- Unique skills are needed to operate different pieces of equipment.
 - Industrial truck and tractor operators* use machinery equipped with lifting devices to carry loads. They also pull trailers loaded with materials, goods, or equipment.
 - Excavation and loading machine operators* control machinery that is equipped with scoops, shovels, or buckets to excavate sand, gravel, and earth. They also load materials into trucks or onto conveyors.
 - Crane and tower operators* use equipment that lifts materials, machinery, and other heavy objects with a hook that is attached to a load line.
 - Hoist and winch operators* control the movement of cables, cages, and platforms to move workers and materials for industrial operations.
- Most equipment operators keep records of the materials that they have moved. They are also responsible for cleaning, fueling, and servicing their machinery.

Working Conditions

- Material moving equipment operators usually work outdoors, through all weather conditions. However, most industrial truck and tractor operators work in warehouses or manufacturing plants.
- Machinery can be very noisy. It can also shake or jolt the operator.
- To reduce the risk of injury, proper operating procedures must be followed at all times. Workers must adhere to strict safety guidelines and use safety equipment when it is available.

Employment

- Material moving equipment operators held about 876,900 jobs in 2004 in the United States and approximately 41,170 jobs in Pennsylvania.
- Although found in many different industries, the majority were employed with manufacturing establishments. Others worked in the transportation, wholesale trade, mining, and construction industries.
- The following table includes the industry groups that employed the most material moving equipment operators in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	14,400	35.0%
Transportation & Warehousing	12,600	30.6%
Trade	5,940	14.4%
Mining	2,310	5.6%

Job Outlook

- Employment of material moving equipment operators in Pennsylvania is expected to increase from approximately 41,170 in 2004 to approximately 44,820 in 2014. These operators can expect about 405 openings due to growth and about 848 replacement openings for approximately 1,253 total annual openings.
- An increased demand for material moving equipment operators will stem from an expanding economy and increased spending on infrastructure. However, equipment improvements continue to raise worker productivity and moderate the demand for skilled operators.

- Above average employment growth is expected in construction companies, temporary help organizations, and equipment leasing companies. However, fewer operators will be needed in the manufacturing industry.
- The construction and manufacturing industries are sensitive to changes in economic conditions. Therefore, the number of job openings in these industries may fluctuate from year to year.

Earnings

- In Pennsylvania, material moving equipment operator wages averaged \$28,300 to \$44,700 annually in 2005. Entry-level wages were between \$19,400 and \$32,800, while experienced operators earned anywhere from \$31,300 to \$50,600.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for different material moving equipment operators in Pennsylvania.

Occupational Title	Average Annual Wage	Entry Level Wage	Experienced Level Wage
Conveyor Operators & Tenders	\$28,830	\$22,200	\$32,140
Crane & Tower Operators	\$36,600	\$26,590	\$41,610
Dredge Operators	\$29,360	\$25,480	\$31,310
Excavating & Loading Machine & Dragline Operators	\$30,370	\$20,590	\$35,250
Loading Machine Operators, Underground Mining	\$36,830	\$29,020	\$40,740
Hoist & Winch Operators	\$38,600	\$23,400	\$46,210
Industrial Truck & Tractor Operators	\$29,260	\$22,170	\$32,800
Gas Compressor & Gas Pumping Station Operators	\$44,660	\$32,780	\$50,600
Pump Operators	\$36,600	\$27,290	\$41,260
Wellhead Pumpers	\$29,750	\$24,980	\$32,130
Shuttle Car Operators	\$38,990	\$31,300	\$42,830

Training, Other Qualifications and Advancement

Employers prefer to hire high school graduates for entry-level material moving equipment operator positions. Necessary skills are acquired through on-the-job training programs. These programs enable apprentices and trainees to operate light equipment under the guidance of an experienced worker. As experience is gained, these workers move on to heavier equipment, such as cranes.

Although most operators receive no formal training, there are some vocational schools that offer instruction in the operation of material moving equipment. Graduates of these programs may have an advantage when looking for an apprenticeship or trainee position. Before starting any formal training program, the reputation of the school should be checked amongst employers in the area.

Material moving equipment operators need a good sense of balance and eye-hand-foot coordination. They should also be able to accurately judge distance. Mechanical aptitude and prior training in mechanics may be helpful because workers may have to maintain their machines. Previous experience operating mobile equipment, such as in the Armed Forces, is also an asset.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of material moving equipment operators include railroad yard workers, construction equipment operators, farm equipment operators, truck drivers, and bus drivers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Specialized Carriers and Rigging Association, 2750 Prosperity Ave., Suite 620, Fairfax, VA 22301-4312. Internet: <http://www.scranet.org>

Pest Controllers

SOC CODE: 37-2021

Significant Points

- Those with the necessary skills and interests should have favorable job prospects.
- Firms who provide services to buildings employed most pest controllers.
- Federal and State laws require certification for all pest control applicators.

Nature of the Work

- Pest controllers locate, identify, destroy, and repel unwanted pests that infest households and buildings.
- The best-known method of pest control is pesticide application. There are two types of pesticides – general use and restricted. General use pesticides are the most widely used and are readily available, in diluted concentrations, to the public. Restricted use pesticides are available only to certified professionals for controlling the most severe infestations. Federal law, as interpreted by the Environmental Protection Agency (EPA), regulates their registration, labeling, and application.
- A combination of pest management techniques, known as integrated pest management, is becoming more popular for several reasons. First, pesticides can pose environmental and health risks. Second, some pests are becoming resistant to certain pesticides. Finally, an integrated pest management plan is more effective in the long term than use of a pesticide alone.
- Most pest controllers perform duties for one of three positions – pest control service technician, applicator or supervisor.

Pest control service technicians identify problem areas and operate and maintain traps. They may make sales presentations. Technicians are licensed to apply pesticides only under an applicator's supervision.

Certified pest control applicators, sometimes called exterminators, perform the same tasks as technicians but are certified to apply all pesticides without supervision. They are licensed to supervise and train technicians. Within this group of workers are termite exterminators, who specialize in controlling termites, and fumigators, who control pests using poisonous gasses called fumigants.

Pest control supervisors direct service technicians and certified applicators. Supervisors are licensed to apply pesticides but are usually more involved in running the business. They are responsible for ensuring employee adherence to rules and must resolve problems with regulatory officials.

Working Conditions

- About half of all pest controllers work 40-hour weeks. Evening and weekend shifts are common.
- They work indoors and outdoors through all weather conditions. During warm weather, applicators may be uncomfortable wearing the heavy protective gear required for working with pesticides.
- Pest controllers must kneel, bend, reach, and crawl to inspect, modify, and treat structures.
- Many pest control chemicals are toxic and could pose health risks if not used properly. Extensive safety training and the use of recommended protective equipment minimize these health risks.

Employment

- Pest controllers held about 68,500 jobs in 2004 in the United States and approximately 1,700 jobs in Pennsylvania.
- Exterminating and pest control companies employed 88 percent. Another eight percent were self-employed.

Job Outlook

- Employment of pest controllers in Pennsylvania is expected to grow from approximately 1,700 in 2004 to approximately 1,960 in 2014. Pest controllers can expect about 25 openings due to growth and about 26 replacement openings for approximately 51 total annual openings.
- Many people do not find pest control work appealing, so those with the necessary skills and interests should have many opportunities.
- Demand for pest controllers will increase as environmental and health concerns increase and as more people decide to hire professionals rather than attempt pest control work themselves.
- Tougher regulations limiting pesticide use will demand more complex integrated pest management strategies.

Earnings

- Average annual earnings of pest controllers in Pennsylvania were \$31,420 in 2005. The entry-level wage for a pest controller in 2005 was \$20,320 while an experienced pest controller made \$36,970.
- Many pest controllers earn a commission in addition to their wages. Some firms also offer bonuses to workers who exceed their performance goals.

Training, Other Qualifications and Advancement

For most pest controller jobs, a high school diploma or equivalent is the minimum qualification for entry-level positions. Almost one-third of all pest controllers have either attended college or earned a degree.

Pest controllers usually begin their careers as apprentice technicians. Time is spent in the classroom and on-the-job. After completing the required training sessions, apprentice technicians can provide supervised pest control services. Apprentices then have up to one year to prepare for and pass the written examinations that are required to become a licensed technician.

Federal and State laws require pest controllers be certified. To be eligible to become a certified pest control applicator, technicians must have one year of experience and at least six months as a licensed technician. This requirement is sometimes waived for individuals with a college degree in biological sciences or extensive related experience. To become certified, technicians must pass a set of exams. Because the pest control industry is constantly changing, workers must attend continuing education classes to maintain their certification.

Aspiring pest controllers must have basic skills in math, chemistry, and writing. Extensive customer interaction requires good communication and interpersonal skills as well. In addition, most pest control companies require a good driving record. Pest controllers must be in good health and able to withstand extreme conditions.

Certified pest control applicators with several years of experience often become supervisors. To qualify, applicators must pass State-administered exams and have a minimum of two years experience. Many pest control supervisors are self-employed.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of pest controllers include construction trades workers, building cleaning workers, and heating, air-conditioning, and refrigeration technicians.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- National Pest Management Association, 8100 Oak St., Dunn Loring, VA 22027.
Internet: <http://www.pestworld.org>

Power Plant Operators, Distributors & Dispatchers

SOC CODES: 51-8011, 51-8012 and 51-8013

Significant Points

- Keen competition is expected for these high-paying jobs.
- Utility company restructuring will result in fewer jobs and reduced job security.
- High school graduates with strong math and science skills are preferred for entry-level positions.

Nature of the Work

- Electric power generating plant operators control the machinery and equipment that generates electricity.
Control room operators are employed in plants where the automated control systems are located in a central room.
Switchboard operators work in older plants where the equipment controls are not centralized.
Auxiliary equipment operators monitor valves, switches, and gauges throughout the plant.
Reactor operators are authorized to control nuclear power plant equipment. A senior reactor operator acts as the supervisor of the plant for each shift and supervises operations in the control room.
- *Power distributors and dispatchers*, also called *load dispatchers* or *systems operators*, control the flow of electricity through a network of transmission lines to industrial plants and substations. They monitor equipment and may anticipate power needs of residential customers.

Working Conditions

- Most power plant employees work a rotating schedule of eight-hour or 12-hour shifts. Rotating shift work can be stressful and fatiguing.
- Operators spend most of their time sitting and standing at control stations. Although the work is not physically strenuous, constant attention is needed.
- Workers employed outside of the control room may be exposed to danger from electric shock, falls, and burns.
- Nuclear power plant operators are often subject to random drug and alcohol tests.

Employment

- Power plant workers held about 46,660 jobs in 2000 in the United States and approximately 2,120 jobs in Pennsylvania.
- About 80 percent worked for utility companies that produce electricity. Others worked for State and local government agencies.

Job Outlook

- Employment of power plant workers in Pennsylvania is expected to decrease from approximately 2,120 in 2004 to approximately 1,750 in 2014. About 57 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Keen competition is expected for these high-paying jobs. Declining employment and low turnover will result in few job opportunities for the large number of qualified candidates.
- Utility companies are restructuring operations to reduce costs and compete effectively. This results in fewer jobs and reduced job security.

Earnings

- No Pennsylvania-specific wage information was available for nuclear power reactor operators. However, the national average annual earnings of nuclear power reactor operators were \$66,900 in 2005.
- Average annual earnings of power distributors & dispatchers in Pennsylvania were \$57,720 in 2005. The entry-level wage in 2005 was \$41,930 while experienced power distributors & dispatchers made \$65,620.
- Average annual earnings of power plant operators in Pennsylvania were \$51,090 in 2005. The entry-level wage for a power plant operator in 2005 was \$35,570 while an experienced power plant operator made \$58,860.

Training, Other Qualifications and Advancement

Most employers prefer to hire high school graduates with strong math and science skills for entry-level positions. College level courses or prior experience in a mechanical or technical job may be helpful. Computer proficiency is also very important.

Entry-level operators are assigned to training based on the results of aptitude tests, worker preferences, and availability of openings. On-the-job training programs combine classroom instruction and hands-on experience. Several years of extensive training and experience are required to become a fully qualified power plant operator.

Extensive training and experience are needed to pass the Nuclear Regulatory Commission (NRC) examinations for licensed reactor operators. Training may include simulator sessions, on-the-job experience, classroom instruction, and individual study. Once licensed, reactor operators must pass annual practical examinations and biannual written examinations to maintain their license.

Periodically, power plant workers are given training courses to refresh their skills. Nuclear power plant operators receive these courses more often. Sessions are usually given on simulators designed to replicate procedures and situations that might be encountered at the power plant.

Power plant workers with advanced training and several years of experience may be promoted to shift supervisor or senior reactor operator positions. Because most utility companies promote from within, there are limited opportunities to advance by transferring to another organization.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of electric power plant workers include chemical plant operators, stationary engineers, water and wastewater treatment plant operators, and refinery operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Brotherhood of Electrical Workers, 1125 15th St. NW, Washington, DC 20005. Internet: <http://www.ibew.org>
- Utility Workers Union of America, 815 16th St. NW, Washington, DC 20006. Internet: <http://www.uwua.org>

Stationary Engineers & Boiler Operators

SOC CODE: 51-8021

Significant Points

- Employment opportunities will be best for those with training in computerized systems.
- Skills may be obtained through apprenticeship programs or on-the-job training.
- Licensing requirements vary from location to location.

Nature of the Work

- *Stationary engineers & boiler operators* operate and maintain the heating, air-conditioning, and ventilation systems that keep large buildings comfortable. They monitor meters, gauges, and computerized controls to ensure safe, economical operation of the systems.
- Hand and power tools are used to perform repairs and routine maintenance. Relevant events and facts concerning operation and maintenance are recorded in an equipment log.
- Mechanical systems within new buildings are generally computer-controlled and can be monitored from a central location.
- Some stationary engineers & boiler operators perform other maintenance duties, such as carpentry, plumbing, and electrical repair.

Working Conditions

- Stationary engineers & boiler operators usually work 40 hours per week. They may rotate among three shifts. In addition, weekend and holiday work may be required.
- Engine rooms, power plants, and boiler rooms are generally clean and well-lit. However, some stationary engineers & boiler operators may be exposed to dust, heat, and noisy conditions.
- Workers spend most of the day on their feet. Crawling, crouching or kneeling may be required to inspect, clean, or repair certain equipment.
- Safety procedures must be followed to guard against burns, electrical shock, and hazardous material exposure.

Employment

- Stationary engineers & boiler operators held about 49,900 jobs in 2004 in the United States and approximately 1,510 jobs in Pennsylvania.
- About 19 percent were employed with hospitals. Others worked for colleges or electric generation companies.
- The following table includes the industries that employed the most stationary engineers & boiler operators in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
General Medical & Surgical Hospitals	280	18.5%
Colleges & Universities	120	7.6%
Power Generation & Supply	90	6.2%
Iron & Steel Mills & Ferroalloys	90	6.0%
Activities Related to Real Estate	80	5.2%

Job Outlook

- Employment of stationary engineers & boiler operators in Pennsylvania is expected to decrease slightly from approximately 1,510 in 2004 to approximately 1,490 in 2014. About 28 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Commercial and industrial development will increase the amount of equipment that needs to be operated and maintained. However, automated systems and computerized controls increase the efficiency of this new equipment. As a result, fewer stationary engineers & boiler operators will be needed.

- Employment opportunities will be best for those with apprenticeship or vocational school training in computerized systems.

Earnings

Average annual earnings of stationary engineers & boiler operators in Pennsylvania were \$43,500 in 2005. The entry-level rate in 2005 was \$31,160 while an experienced stationary engineer made \$49,680.

Training, Other Qualifications and Advancement

Stationary engineering skills may be acquired through apprenticeship programs or on-the-job training. The Navy and Merchant Marines also provide valuable experience. Although many stationary engineers & boiler operators have some college education, most employers require only a high school diploma or its equivalent. Mechanical aptitude, manual dexterity, and good physical condition are important qualities for aspiring stationary engineers & boiler operators.

Apprenticeship programs, which last about four years, are sponsored by The International Union of Operating Engineers. These programs combine classroom instruction with hands-on experience. When evaluating applicants, apprenticeship committees look for previous education or training in mathematics, computers, mechanical drawing, machine-shop practice, physics, and chemistry.

On-the-job trainees begin as boiler tenders or helpers to experienced workers. Practical experience is usually supplemented with post-secondary training in computerized controls and instrumentation. Many years of on-the-job experience are required to become a stationary engineer. Employers encourage and often pay for skill-improving training. In fact, additional training is usually provided when new equipment is introduced and when regulations change.

Licensing requirements vary from city to city. In fact, stationary engineers & boiler operators who relocate may have to apply for a new license. Regardless of the location, there are several classes of stationary engineer licenses. Each class specifies which equipment the worker can operate without supervision. The highest level, a first-class license, allows stationary engineers & boiler operators to operate all types of equipment and supervise other workers. Applicants for this license should have obtained a high school diploma, completed a stationary engineering training program, and accumulated several years of practical experience.

Advancement opportunities are best for stationary engineers & boiler operators who obtain higher-class licenses. Some become boiler inspectors, chief plant engineers, plant superintendents, or building managers. A few take jobs as examining engineers or technical instructors.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of stationary engineers & boiler operators include operators of water treatment plants, wastewater treatment plants, waterworks pump-stations, chemical plants, gas plants, nuclear reactors, power stations, and refineries.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Union of Operating Engineers, 1125 17th St. NW, Washington, DC 20036.
Internet: <http://www.iuoe.org>
- The National Association of Power Engineers Inc., 1 Springfield St., Chicopee, MA 01013.
Internet: <http://www.powerengineers.com>
- Building Owners and Managers Institute, 1521 Ritchie Hwy, Arnold, MD 21012.
Internet: <http://www.bomi-edu.org>

Veterinarians

SOC CODE: 29-1131

Significant Points

- Competition for admission to veterinary school is keen.
- Those who work with large, farm animals may have better job prospects than small animal practitioners.
- About 15 percent of veterinarians were self-employed.

Nature of the Work

- **Veterinarians** play a major role in the health care of pets and livestock as well as zoo, sporting, and laboratory animals. Some conduct clinical research on human and animal health problems. Others inspect livestock, meat, poultry, and egg products.
- Most veterinarians work in private practices. They diagnose animal health problems, vaccinate against diseases, provide medication, treat and dress wounds, set fractures, perform surgery, and advise owners about animal feeding, behavior, and breeding. Veterinarians also euthanize animals when necessary.
- Small animal practitioners care for dogs, cats, and other pets. Some also see pigs, goats, and sheep. A small number of private practice veterinarians work exclusively with large animals, mostly horses and cows. Others care for zoo, aquarium, or laboratory animals.
- Veterinarians who treat animals use medical equipment and diagnostic equipment. Those working in research use a full range of sophisticated laboratory equipment.
- A number of veterinarians work with physicians and scientists as they research ways to prevent and treat human health problems, such as cancer, AIDS, and alcohol or drug abuse. Veterinarians help determine the effects of drug therapies, antibiotics or new surgical techniques by testing them on animals.

Working Conditions

- Veterinarians often spend 50 or more hours on the job. Solo practitioners often work extended and weekend hours, responding to emergencies or squeezing in unexpected appointments. Those in group practices usually take turns being on call for evening or weekend work.
- Large animal practitioners spend a great deal of time driving between their office and farms or ranches. They work outdoors in all kinds of weather and have to treat animals under less-than-sanitary conditions.
- In non-clinical areas, veterinarians work in clean, well-lit offices or laboratories. Much of their time is spent dealing with people rather than animals.

Employment

- Veterinarians held about 60,500 jobs in 2004 in the United States and approximately 1,770 jobs in Pennsylvania.
- Most veterinarians, about 81 percent, were employees of a group veterinary practice. Another 15 percent were self-employed.

Job Outlook

- Employment of veterinarians in Pennsylvania is expected to grow from approximately 1,770 in 2004 to approximately 2,050 in 2014. Veterinarians can expect about 28 openings due to growth and about 43 replacement openings for approximately 71 total annual openings.
- Small animal practitioners will face keen competition for jobs. They may have to take positions requiring a lot of evening or weekend work. Job prospects may be better for those who specialize in treating farm animals than for small animal practitioners.
- Continued support for public health and food safety, disease control programs, and biomedical research will create demand for veterinarians, although such positions are few in number. The best opportunities for veterinarians with training in public health and epidemiology are with the Federal Government.

Earnings

Average annual earnings of veterinarians in Pennsylvania were \$84,540 in 2005. The entry-level wage for a veterinarian in 2005 was \$51,310 while an experienced veterinarian made \$101,150.

Training, Other Qualifications and Advancement

Veterinarians must graduate from an accredited college of veterinary medicine with a Doctor of Veterinary Medicine (D.V.M. or V.M.D.) degree and obtain a license to practice. However, competition for admission to veterinary schools is keen. Most of the students admitted to veterinary schools have completed an undergraduate program, have a GPA of 3.0 or better, and have previous hands-on experience.

Veterinary school applicants must complete pre-veterinary courses such as organic and inorganic chemistry, physics, biochemistry, general biology, animal biology, animal nutrition, genetics, vertebrate embryology, cellular biology, microbiology, zoology, and systemic physiology. They must submit test scores from the Graduate Record Examination (GRE), the Veterinary College Admission Test (VCAT), or the Medical College Admission Test (MCAT), depending on the preference of the college. Additionally, veterinary medical schools weigh heavily a candidate's veterinary and animal experience. Any hands-on experience, formal or informal, is advantageous.

While in veterinary school, students receive additional academic instruction in the basic sciences for the first two years. Later in the program, they are exposed to clinical procedures and laboratory work. At most schools, students who plan a career in research can earn both a D.V.M degree and a Doctor of Philosophy (Ph.D.) degree at the same time.

Veterinarians must be licensed and those planning to specialize in a certain field usually complete a one-year internship. Interns receive a small salary but usually find that their internship experience leads to a higher starting salary. Those seeking board certification in a specialty must complete a two- to three-year residency program that provides intensive training in their specialty.

Potential veterinarians must have good manual dexterity, an affinity for animals, and the ability to get along with animal owners. Additionally, they should be able to quickly make decisions in emergencies.

Most veterinarians begin as employees or partners in established practices. With experience, many set up their own practice or purchase an established one. Some veterinarians become meat and poultry inspectors, disease-control workers, epidemiologists, research assistants, or commissioned officers in the U.S. Public Health Service, U.S. Army or U.S. Air Force.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of veterinarians include chiropractors, dentists, optometrists, physicians, podiatrists, biological scientists, medical scientists, and animal scientists. Animal trainers, animal breeders, and veterinary technicians also work extensively with animals, however the level of training required for these occupations is substantially less.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Veterinary Medical Association, 1931 N. Meacham Rd., Suite 100, Schaumburg, IL 60173. Internet: <http://www.avma.org>
- Association of American Veterinary Medical Colleges, 1101 Vermont Ave. NW, Suite 710, Washington, DC 20005. Internet: <http://aavmc.org>
- National Association of Federal Veterinarians, 1101 Vermont Ave. NW, Suite 710, Washington, DC 20005. Internet: <http://users.erols.com/nafv>

Veterinary Assistants & Non-farm Animal Caretakers

SOC CODES: 31-9096 and 39-2021

Significant Points

- Opportunities should be good, except for zookeepers.
- Formal training is not required for most entry-level positions.
- About 1 in 6 were self-employed.

Nature of the Work

- **Animal caretakers**, or attendants, feed, water, groom, bathe, and exercise animals and maintain their cages. They also play with the animals, provide companionship, and observe behavioral changes. Those who specialize in maintaining an animal's appearance are called **groomers**.
- In kennels, animal attendants care for small animals while their owners are working or out of town. Entry-level attendants clean cages, fill food dishes, and exercise animals. Experienced attendants provide basic health care and grooming needs. Some sell pet food and supplies, assist in obedience training, or help with breeding.
- Attendants in animal shelters keep records of the animals received and discharged and of any tests or treatments done. They also attend to the basic needs of the animals and interact with the public.
- **Grooms** care for horses in stables. They clean out stalls, polish saddles, organize tack rooms, and store supplies in addition to feeding, grooming, and exercising the horses. Experienced grooms may also help train horses.
- **Veterinary assistants** work in animal hospitals or clinics. They observe animals recovering from surgery, check wound dressings, and notify the doctor if anything seems out of the ordinary. They also maintain the sanitary conditions in the hospital.
- **Laboratory animal caretakers** work in research facilities. They fill food and water dishes, maintain cages, and observe the animals for signs of illness, disease, or injury. They may also administer medications, prepare laboratory samples, sterilize laboratory equipment, and record information regarding genealogy, diet, weight, medications, and food intake.
- In zoos, **keepers** prepare diets, clean animal enclosures, and assist in raising the animals. They watch for signs of illness or injury, monitor eating patterns, and observe behavioral changes. Keepers may answer questions and ensure that the visiting public behaves responsibly toward the exhibited animals.

Working Conditions

- Most veterinary assistants and non-farm animal caretakers work about 40 hours a week. Work hours may be irregular and evening, weekend, and holiday shifts are common.
- Animal caretaker work may involve kneeling, crawling, repeated bending, and heavy lifting. Their work setting may be noisy due to all of the animals. Some work outdoors through all kinds of weather.
- Although their job is not overly dangerous, many risk exposure to bites or scratches.
- Veterinary assistants and non-farm animal caretakers who witness abused animals or who assist in the euthanizing of animals may experience emotional stress.

Employment

- Veterinary assistants and non-farm animal caretakers held about 202,400 jobs in 2004 in the United States and approximately 6,740 jobs in Pennsylvania.
- About 28 percent worked in veterinary clinics. Others worked in boarding kennels, animal shelters and grooming shops. Over 15 percent were self-employed.
- The following table includes the industries that employed the most veterinary assistants and non-farm animal caretakers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Other Professional & Technical Services	1,890	28.0%
Other Personal Services	1,060	15.8%
Self-Employed	1,040	15.5%
Social Advocacy Organizations	840	12.5%

Job Outlook

- Employment of veterinary assistants & non-farm animal caretakers in Pennsylvania is expected to grow from approximately 6,740 in 2004 to approximately 7,850 in 2014. These workers can expect about 111 openings due to growth and about 155 replacement openings for approximately 266 total annual openings.
- Employment opportunities for veterinary assistants and non-farm animal caretakers are expected to be good. However, caretakers seeking jobs in zoos will face keen competition for openings.
- Although the growth of the pet population is expected to slow, demand for veterinary assistants and non-farm animal caretakers in kennels, grooming shops, animal shelters, and veterinary clinics and hospitals is expected to remain steady.

Earnings

- Average hourly earnings of veterinary assistants & laboratory animal caretakers in Pennsylvania were \$10.81 in 2005. The entry-level rate in 2005 was \$7.56 while an experienced veterinary assistant made \$12.43.
- Average hourly earnings of non-farm animal caretakers in Pennsylvania were \$8.97 in 2005. The entry-level rate in 2005 was \$6.58 while an experienced caretaker made \$10.16.

Training, Other Qualifications and Advancement

Formal training is not usually required for entry-level positions. In fact, most animal caretakers are trained on the job. Employers do prefer applicants with some previous experience dealing with animals. Training requirements and opportunities for advancement vary by employer.

Pet groomers usually learn their trade by completing an informal six to 10 week apprenticeship. Some may attend a formal training program at a licensed grooming school. The National Dog Groomers Association of America certifies groomers who pass a written examination as well as a practical skills test. Experienced groomers may advance into supervisory or managerial positions. Some open their own shops.

Kennel workers learn on the job and usually begin their training by cleaning cages and feeding animals. The American Boarding Kennels Association (ABKA) does offer a three-stage, home-study program. The first two stages address basic and advanced principles of animal care while the third stage focuses on in-depth animal care and good business procedures. Those who complete the program and pass oral and written examinations become Certified Kennel Operators (CKO). Kennel workers with experience may be promoted to kennel supervisor, assistant manager, or manager. Some choose to open their own kennels.

Caretakers in animal shelters are not required to have any specialized training. However, programs and workshops are available through the Humane Society of the United States, the American Humane Association, and the National Animal Control Association. With experience and additional training, caretakers in animal shelters may become adoption coordinators, animal control officers, emergency rescue drivers, assistant shelter managers, or shelter directors.

There are no formal educational requirements for veterinary assistants. They are usually trained on-the-job by a veterinarian or veterinary technician. Highly motivated veterinary assistants may become veterinary technicians upon graduation from an accredited veterinary technology program.

Employers of laboratory animal caretakers often require a high school diploma or equivalent. Laboratory animal caretakers may obtain certification from The American Association for Laboratory Animal Science (AALAS). Those who wish to become certified as Assistant Laboratory Animal Technicians, Laboratory Animal Technicians, or Laboratory Animal Technologists must satisfy the education and experience requirements of the AALAS before taking the certification examination. Laboratory animal caretakers who have additional training, experience, or certification may advance to more technical positions, such as research assistant, mid-level technician, or senior-level technologist.

Some zoological parks require a bachelor's degree in biology or animal science. Most require previous experience with animals. Zookeepers may advance to senior zookeeper, assistant head zookeeper, head zookeeper, or assistant curator.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of veterinary assistants and non-farm animal caretakers include animal breeders, animal trainers, livestock farm workers, ranchers, veterinarians, veterinary technicians and technologists, and wildlife biologists and zoologists.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- The Humane Society of the United States, 2100 L St. NW, Washington, DC 20037. Internet: <http://www.hsus.org>

- National Animal Control Association, PO Box 480851, Kansas City, MO 64148.
Internet: <http://www.nacanet.org>
- National Dog Groomers Association of America, PO Box 101, Clark, PA 16113.
Internet: <http://www.nationaldoggroomers.com/>
- American Boarding Kennels Association, 1702 E. Pikes Peak Ave., Colorado Springs, CO 80909.
Internet: <http://www.abka.com>
- American Association for Laboratory Animal Science, 9190 Crestwyn Hills Dr., Memphis, TN 38125.
Internet: <http://www.aalas.org>

Veterinary Technologists & Technicians

SOC CODE: 29-2056

Significant Points

- Animal lovers get satisfaction in this occupation.
- Some aspects of the work can sometimes be unpleasant and physically and emotionally demanding.
- Entrants must complete a two- or four-year veterinary technology program, and pass a State examination.

Nature of the Work

- *Veterinary technologists and technicians* typically conduct clinical work in a private practice under the supervision of a veterinarian—often performing various medical tests along with treating and diagnosing medical conditions and diseases in animals.
- They may perform laboratory tests such as urinalysis and blood counts, assist with dental prophylaxis, prepare tissue samples, take blood samples, or assist veterinarians in a variety of tests and analyses in which they often utilize various items of medical equipment, such as test tubes and diagnostic equipment.
- In addition to working in private clinics and animal hospitals, veterinary techs may also work in research facilities. There, they may administer medications orally or topically, prepare samples for laboratory examinations, and record information on genealogy, diet, weight, medications, food intake, and clinical signs of pain and distress.
- Some veterinary technologists vaccinate newly admitted animals and occasionally are required to euthanize seriously ill, severely injured, or unwanted animals.

Working Conditions

- Most full-time veterinary techs work about 40 hours a week, while some work 50 or more hours a week. Some animal hospitals, research facilities, and animal shelters are staffed 24 hours a day, which means some technicians might work night shifts or irregular work schedules.
- In addition to private clinics and animal hospitals, veterinary techs also may work in research facilities.
- Veterinary technicians may sometimes clean cages and lift, hold, or restrain animals, risking exposure to bites or scratches. Some of the work may be unpleasant, physically and emotionally demanding or even dangerous.
- Veterinary techs who witness abused animals or who assist in the euthanizing of animals may experience emotional stress.

Employment

- Veterinary techs held about 60,000 jobs in 2004 in the United States and approximately 2,390 jobs in Pennsylvania.
- Over 98 percent of all veterinary techs were employed in veterinarian offices.

Job Outlook

- Employment of veterinary techs in Pennsylvania is expected to grow from approximately 2,390 in 2004 to approximately 3,140 in 2014. These workers can expect about 75 openings due to growth and about 31 replacement openings for approximately 106 total annual openings.
- Employment opportunities are expected to be good. However, those seeking jobs in zoos will face keen competition for openings.
- Biomedical facilities, diagnostic laboratories, wildlife facilities, humane societies, animal control facilities, drug and food manufacturers, and food safety inspection facilities will provide more jobs for veterinary techs.

Earnings

Average annual wages of veterinary technologists and technicians in Pennsylvania were \$26,310 in 2005. The entry-level wage for a veterinary tech in 2005 was \$19,420 while an experienced veterinary tech made \$29,760.

Training, Other Qualifications and Advancement

There are primarily two levels of education and training for entry to this occupation—a two-year program for veterinary technicians and a four-year program for veterinary technologists. Most entry-level veterinary technicians have a two-year degree, usually an associate degree, from an accredited community college program in veterinary technology, in which courses are taught in clinical and laboratory settings using live animals. A few

colleges offer veterinary technology programs that are longer and that may culminate in a four-year bachelor's degree in veterinary technology. These four-year colleges, in addition to some vocational schools, also offer two-year programs in laboratory animal science.

The American Veterinary Medical Association (AVMA) accredited more than 80 veterinary technology programs in 41 states in 2003. Seven of these programs are currently available in Pennsylvania. Graduation from an AVMA-accredited veterinary technology program allows students to take the credentialing exam. Candidates are tested for competency through an examination that includes oral, written, and practical portions. Employers recommend American Association for Laboratory Animal Science (AALAS) certification for those seeking employment in a research facility.

Persons interested in careers as veterinary techs should take high school science, biology, and math courses. Science courses taken beyond high school, in an associate or bachelor's degree program, should emphasize practical skills in a clinical or laboratory setting. Because veterinary techs often deal with pet owners, communication skills are very important. Additionally, veterinary tech should be able to work well with others, because teamwork with veterinarians is common. Organizational ability and the ability to pay attention to detail also are important.

Veterinary techs usually begin work as trainees in routine positions under the direct supervision of a veterinarian. Entry-level workers whose training or educational background encompasses extensive hands-on experience with a variety of laboratory equipment, including diagnostic and medical equipment, usually require a shorter period of on-the-job training. As they gain experience, veterinary techs take on more responsibility and carry out more assignments under only general veterinary supervision, and some eventually may become supervisors.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of veterinary techs include animal breeders, animal trainers, livestock farm workers, ranchers, veterinarians, veterinary assistants and non-farm animal caretakers, and wildlife biologists and zoologists.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Association for Laboratory Animal Science, 9190 Crestwyn Hills Dr., Memphis, TN 38125. Internet: <http://www.aalas.org>
- American Veterinary Medical Association, 1931 N. Meacham Rd., Suite 100, Schaumburg, IL 60173-4360. Internet: <http://www.avma.org>
- Association of American Veterinary Medical Colleges, 1101 Vermont Ave. NW, Suite 710, Washington DC 20005. Internet: <http://www.aavmc.org>
- National Association of Veterinary Technicians in America, P.O. Box 224, Battle Ground, IN 47920. Internet: <http://www.navta.net>

Water & Liquid Waste Treatment Plant & Systems Operators

SOC CODE: 51-8031

Significant Points

- Completion of a formal training program can increase employment opportunities.
- Job prospects will be best in privately owned facilities and manufacturing firms.
- Local government agencies employed 3 out of every 5.

Nature of the Work

- *Water & liquid waste treatment plant & systems operators* control the processes and equipment that remove or destroy harmful materials and chemical compounds found in water and liquid waste.
- A variety of instruments are used to measure water quality. Computers help monitor equipment, store sampling results, schedule maintenance, and produce reports.
- In order to handle emergency situations, water and liquid waste plant operators are trained in emergency management response.
- Water pollution standards have become increasingly stringent. As a result, plant operators must be familiar with government guidelines and how they affect the plant.

Working Conditions

- Water & liquid waste treatment plant & systems operators work rotating schedules of 8-hour shifts. Weekend and holiday work is common. During emergency situations, overtime may be necessary.
- Plant operators, who work both indoors and outdoors, may be exposed to noise and unpleasant odors.
- Workers may have to stoop, reach, or climb. As a result, they sometimes get their clothes dirty.
- Safety procedures must be followed to reduce the risk of injury from slippery walkways, dangerous gases, and malfunctioning equipment.

Employment

- Water & liquid waste treatment plant & systems operators held about 94,400 jobs in 2004 in the United States and approximately 4,840 jobs in Pennsylvania.
- Almost 60 percent were employed with local government agencies. Others worked for utility companies.

Job Outlook

- Employment of water & liquid waste treatment plant & systems operators in Pennsylvania is expected to grow from approximately 4,840 in 2004 to approximately 5,190 in 2014. These workers can expect about 34 openings due to growth and about 166 replacement openings for approximately 200 total annual openings.
- An expanding population and growing economy are expected to stimulate the demand for water and liquid waste treatment services.
- Although most plant operators are employed with government agencies, most job opportunities will be found in privately owned facilities and manufacturing firms.

Earnings

Average annual earnings of water & liquid waste treatment plant & systems operators in Pennsylvania were \$37,100 in 2005. The entry-level wage in 2005 was \$26,130 while an experienced plant operator made \$42,590.

Training, Other Qualifications and Advancement

Most employers require a high school diploma for entry-level water and liquid waste treatment plant & systems operator jobs. Completion of a formal training program can increase an applicant's chances for employment and promotion. However, many plant operators still acquire their skills through on-the-job training. Certain positions are covered by civil service regulations. Applicants for these positions may be required to pass a written examination before being hired.

Trainees usually start as attendants or operators-in-training. They learn basic skills by observing experienced operators and performing routine tasks. In larger facilities, on-the-job training is often combined with formal classroom instruction or self-paced study programs. At the end of their training, operators must pass an examination to certify that they are capable of overseeing plant operations. There are different levels of certification depending on the operator's experience and training.

Water & liquid waste treatment plant & systems operators need mechanical aptitude. A basic knowledge of mathematics, chemistry, and biology is also very important. Computer skills are needed to operate modern instruments and equipment. To ensure that the plant is operating efficiently, plant operators must have the ability to apply data and adjust the treatment process as necessary.

Experienced water & liquid waste treatment plant & systems operators may be assigned to more complex treatment processes, which require a greater knowledge of governmental regulations. Additional training may be required for promotion to plant supervisor or superintendent positions. Some treatment plant and systems operators transfer to larger facilities in search of advancement opportunities. Others take related positions with pollution control agencies, wholesale companies, consulting firms, and vocational-technical schools.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of water & liquid waste treatment plant & systems operators include operators of boilers, gas plants, power plants, power reactors, turbines, chemical plants, and petroleum refineries.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Association of Boards of Certification, 208 Fifth St., Ames, IA 50010-6259. Internet: <http://www.abccert.org>
- American Water Works Association, 6666 W. Quincy Ave., Denver, CO 80235. Internet: <http://www.awwa.org>
- Water Environment Federation, 601 Wythe St., Alexandria, VA 22314-1994. Internet: <http://www.wef.org>

Manufacturing

Manufacturing Introduction

These occupations are found in metalworking, precision assembly, printing, textiles, woodworking, and many other industries.

Despite a gradual decline in overall employment, manufacturing continues to play a pivotal role in the Pennsylvania economy. Manufacturing workers account for approximately 9% of Pennsylvania's employment and generally earn higher wages than the average worker in private industry. Most of these occupations can be learned through on-the-job training; however, many require technical school training as well.

Although there has been an overall steady decline in manufacturing employment for many years, the degree of decline varies by industry. The most significant decrease in is expected to be in textiles and apparel, where nearly half of all workers are sewing machine operators. Increased imports and new technology are largely responsible for this decline. Limited job openings in textiles and apparel will arise from replacement needs as experienced workers transfer to other industries, retire, or leave the workforce.

Automation has led to a changing occupational make-up within many manufacturing industries. Technological advances in machinery have allowed computer-numerically-controlled (CNC) machines to be used increasingly in metal and plastics production. CNC machines operate automatically and require less hands-on interaction than with manual machinery, thereby reducing the amount of technical training needed to operate them.

Occupations requiring more extensive training include tool and die makers, welders, and woodworkers. These occupations usually require apprenticeships or extensive on-the-job training programs and classroom instruction.

Apparel Workers

Bindery Workers

Blue-Collar Worker Supervisors

Drafters

Handlers, Equipment Cleaners, Helpers & Laborers

Industrial Production Managers

Inspectors, Testers, Sorters, Samplers & Weighers

Machinists

Metal & Plastics Machine Operators

Painting & Coating Workers

Precision Assemblers

Prepress Technicians & Workers

Printing Machine Operators

Production, Planning & Expediting Clerks

Shoe & Leather Workers & Repairers

Structural & Reinforcing Metal Workers

Textile Machinery Operators

Tool & Die Makers

Welding, Solderers & Brazing Workers

Woodworkers

Auxiliary aids and services are available upon request to individuals with disabilities.
Equal Opportunity Employer/Program

Contact the Center for Workforce Information & Analysis for alternate formats at workforceinfo@state.pa.us, (717) 787-6466 or
toll-free at 1-877-493-3282.

Apparel Workers

SOC CODES: 51-6021, 51-6031, 51-6051, 51-6052, 51-6092 and 51-9031

Significant Points

- Skills are learned through on-the-job training programs.
- Increased use of imports, offshore assembly, and automation will cause a decline in employment levels.
- About 1 in 5 were self-employed.

Nature of the Work

- Apparel workers transform cloth, leather, and fur into clothing and other consumer products. They may also repair and alter these products. Most workers concentrate on one particular part of the production process.

Fabric and apparel patternmakers use a computer to convert a sample product into a pattern.

Markers determine the best arrangement of pattern pieces to minimize fabric waste.

Cutting machine operators monitor computer-controlled machines, which perform all of the necessary cutting functions automatically.

Hand cutters are responsible for manually cutting delicate and valuable fabrics.

Sewing machine operators take the individual material pieces and sew them together. Workers may produce garment or non-garment products.

Hand sewers concentrate on delicate and valuable fabrics that cannot be sewn with a machine. These workers often specialize in a particular operation, such as sewing buttonholes or adding trim.

Pressers ensure that finished products are wrinkle-free. Some use steam-pressing machines, which are more productive than hand pressing.

Custom tailors and sewers are highly skilled workers who prepare garments from start to finish. Some make alterations and adjustments to ready-to-wear clothing.

- In larger firms, many operations have been automated and computerized. However, there are many smaller apparel production firms that lack the resources to invest in new equipment.

Working Conditions

- Individuals employed in apparel production occupations generally work 35 to 40 hours per week. Those employed in retail stores and laundry establishments may work evening and weekend shifts.
- While older factories tend to be congested and poorly lit, modern facilities are spacious and well-lit. Some environments may be hot and noisy.
- Some apparel workers sit for long periods of time. Others spend hours on their feet, usually leaning over tables and operating machinery. A few workers wear protective devices such as gloves.
- To increase interpersonal contact, many companies have introduced the modular manufacturing system. This process, which emphasizes teamwork and cooperation, increases productivity and reduces production time.

Employment

- Apparel workers held about 461,100 jobs in 2004 in the United States and approximately 20,120 jobs in Pennsylvania.
- Most were employed with manufacturing companies, especially those that produce clothing for men, women and children. Others were employed in laundry and dry-cleaning establishments.
- The following table includes the industry groups that employed the most apparel workers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	11,450	56.9%
Services	4,090	20.3%
Self-Employed	2,510	12.5%
Wholesale & Retail Trade	1,620	8.1%

Job Outlook

- Employment of apparel workers in Pennsylvania is expected to decrease from approximately 20,120 in 2004 to approximately 14,000 in 2014. About 307 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Declining employment levels of apparel workers can be attributed to the increased use of imports, offshore assembly, and other technological advancements. However, many pre-sewing functions will continue to be done domestically, and these workers will not be as adversely affected.
- As consumers opt to purchase mass-produced goods, custom tailors and sewers will also experience fewer job opportunities.

Earnings

- Overall, fabric and apparel patternmakers earned the highest wages at all levels of experience. Hand sewers had the lowest wages across all levels of experience.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different apparel working occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Pressers: Textile, Garment & Related Materials	\$8.84	\$6.59	\$9.97
Sewing Machine Operators	\$9.58	\$6.73	\$11.01
Sewers, Hand	\$7.79	\$6.03	\$8.67
Tailors, Dressmakers & Custom Sewers	\$11.65	\$7.72	\$13.62
Fabric & Apparel Patternmakers	\$14.63	\$8.88	\$17.50
Cutters & Trimmers, Hand	\$10.59	\$7.39	\$12.19

Training, Other Qualifications and Advancement

Training requirements vary by industry. Although formal training or previous work experience may improve employment opportunities, few manufacturing companies require it. In fact, most production and laundry workers are inexperienced. Retailers prefer to hire custom sewers with previous experience in apparel manufacture, design, or alterations.

Apparel workers often learn their skills from experienced workers through on-the-job training. After mastering simple tasks, trainees are assigned to more difficult operations. A trend toward cross-training employees will require trainees to spend time learning how to operate a variety of machines. As the industry becomes more complex, apparel workers will need training in the basics of computers and electronics.

In general, apparel workers need good hand-eye coordination. Workers must be able to perform repetitive tasks for long periods of time. Knowledge of fabrics, design, and construction is very important.

Advancement opportunities are limited. Although some apparel workers advance to supervisory positions, many remain on the production line. With additional training, some patternmakers become designers. Experienced custom sewers may open their own tailoring shop.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of apparel workers include precision woodworkers, precision assemblers, upholsterers, leather workers, and operators of textile, metalworking, plastics working, and shoe sewing machines.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Apparel & Footwear Association, 1601 N. Kent St., Suite 1200, Arlington, VA 22209. Internet: <http://www.apparelandfootwear.org>

Bindery Workers

SOC CODES: 51-5011 and 51-5012

Significant Points

- Technological advances have improved product appearance and reduced the amount of labor that is needed.
- Experienced workers will have the best opportunities.

Nature of the Work

- Bindery workers combine printed sheets into finished products such as books, magazines, catalogs, folders, and directories. Workers may cut, fold, gather, glue, staple, stitch, trim, sew, or wrap pages together. Job duties depend on the kind of materials being bound.

Edition binding workers bind books that are produced in large numbers.

Job binding workers bind books that are produced in smaller quantities.

Library binding workers repair books and provide other specialized binding services to libraries.

Pamphlet binding workers produce leaflets and folders.

Manifold binding workers bind business forms, such as ledgers and receipt books.

Blank book binding workers bind blank pages together to produce notebooks, checkbooks, address books, diaries, calendars, and note pads.

- Unlike single-step binding processes, bookbinding is comprised of a complex set of steps. Bookbinders assemble their products from large, flat sheets of paper, which are then arranged, folded, and secured together. Once the book body has been formed, glued fabric strips are used to secure the pages. A cover, which is created separately, is added.
- A few bookbinders work in hand binderies. These highly skilled workers design original or special bindings for limited edition books. They may also restore and rebind rare books.

Working Conditions

- Bindery jobs resemble an assembly line. Workers perform repetitive tasks in a noisy environment.
- Considerable lifting, standing, and carrying are required. Workers may also be expected to stoop, kneel or crouch when operating equipment.

Employment

- Bindery workers held about 81,300 jobs in 2004 in the United States and around 4,840 jobs in Pennsylvania.
- Over 83 percent worked in printing companies. Others worked for companies that produce books, blank books, binders and business forms.

Job Outlook

- Employment of bindery workers in Pennsylvania is expected to decrease from approximately 4,840 in 2004 to approximately 4,310 in 2014. About 129 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- The commercial printing industry will continue to grow as more products are marketed through catalogs, newspaper inserts, and direct mail advertising. However, book publishing itself will grow less rapidly.
- Computerized machinery and other technological advances have improved product appearance and reduced the amount of labor that is needed. Specialized bindery workers, such as hand bookbinders, will be most affected by technology. Experienced bindery workers will have the best opportunities.

Earnings

- Average hourly earnings of bindery workers in Pennsylvania were \$14.17 in 2005. The entry-level rate in 2005 was \$9.43 while an experienced bindery worker made \$16.55.
- Average hourly earnings of bookbinders in Pennsylvania were \$15.77 in 2005. The entry-level rate in 2005 was \$11.85 while an experienced bindery worker made \$17.74.

Training, Other Qualifications and Advancement

Most bindery workers acquire their skills through on-the-job training. Inexperienced workers are taught how to perform simple tasks, such as moving paper from one machine to another. As they gain experience, more difficult tasks are assigned and workers are taught how to operate complex machinery. Simple machinery is usually

mastered in one to three months but it may take up to a year to become completely familiar with more complex equipment. To keep pace with the ever-changing industry, many bindery workers are given additional training throughout their careers.

Although formal apprenticeships are less common today, some employers still offer them. Apprenticeships provide a structured program that enables workers to acquire the high levels of specialization and skill needed for some bindery jobs.

Employers prefer to hire experienced individuals, but most will train individuals who have some basic knowledge of binding operations. Previous training in shop and graphic arts can be an asset. Aspiring bindery workers also need basic mathematic and language skills. Workers must pay close attention to detail so accuracy, patience, and good eyesight are important traits. Manual dexterity is essential for counting, inserting, pasting, and folding. Likewise, some mechanical aptitude is needed to operate automated equipment. Artistic ability and imagination are necessary for hand bookbinders.

Without additional training, advancement opportunities are limited for bindery workers. A few experienced bookbinders advance to supervisory positions.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of bindery workers include papermaking machine operators, printing press operators, and various precision machine operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Graphic Communications International Union, 1900 L St. NW, Washington, DC 20036. Internet: <http://www.gciu.org>
- Graphic Arts Information Network. 200 Deer Run Rd., Sewickley, PA 15143. Internet: <http://www.gain.org>
- The Association for Suppliers of Printing, Publishing, and Converting Technologies. 1899 Preston White Dr., Reston, VA 20191. Internet: <http://www.npes.org>

Blue-Collar Worker Supervisors

SOC CODES: 47-1011, 49-1011, 51-1011, 53-1011, 53-1021 and 53-1031

Significant Points

- Employers prefer to promote applicants with postsecondary technical degrees.
- Organizational restructuring and technological developments will moderate employment growth.
- Over one-third worked for manufacturing companies.

Nature of the Work

- *Blue-collar worker supervisors* oversee the work of construction, maintenance, production, and transportation workers. Although duties are varied, a supervisor's primary task is to ensure that workers, materials, and equipment are used properly to maximize productivity.
- Computers are used to schedule procedures, monitor worker output, track materials, update inventory, and perform other supervisory tasks.
- Supervisors inform workers about company policies, provide employee reviews and recommend disciplinary action. They also meet regularly with management to report any problems and discuss possible solutions.

Working Conditions

- Blue-collar worker supervisors usually start the day early and stay late. They may work any shift, as well as weekends and holidays.
- Work environments vary with industry. Many work on a shop floor, where they spend most of the day on their feet. Others work outdoors even in severe weather conditions.
- Organizational restructuring and downsizing have increased supervisor responsibilities. Therefore, on-the-job stress has also increased.

Employment

- Blue-collar worker supervisors held about 2.4 million jobs in 2004 in the United States and approximately 86,060 jobs in Pennsylvania.
- Although found in almost all industries, the majority of blue-collar worker supervisors were found in manufacturing establishments. Others were employed in construction and transportation.
- The following table includes the industry groups that employed the most blue-collar worker supervisors in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	29,140	33.9%
Construction	13,810	16.1%
Wholesale & Retail Trade	10,420	12.1%
Transportation	6,750	7.8%
Government	5,520	6.4%
Self-Employed	4,730	5.5%

Job Outlook

- Employment of blue-collar worker supervisors in Pennsylvania is expected to decrease from approximately 86,060 in 2004 to approximately 89,050 in 2014. Blue-collar worker supervisors can expect about 335 openings due to growth and about 1,829 replacement openings for approximately 2,164 total annual openings.
- Projected job growth varies by industry. For the most part, as the number of blue-collar workers increases, so will the need for supervisors. However, organizational restructuring and technological developments will help moderate employment growth.
- Because of their skill and seniority, blue-collar worker supervisors are usually protected from layoffs during periods of economic decline.

Earnings

- In Pennsylvania, blue-collar worker supervisors averaged \$34,900 to \$57,400 annually in 2005. Entry-level wages were between \$21,900 and \$36,200, while experienced blue-collar worker supervisors earned anywhere from \$41,400 to \$68,000.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for different blue-collar worker supervisors in Pennsylvania.

Occupational Title	Average Annual Wage	Entry Level Wage	Experienced Level Wage
Supervisors - Construction Trades & Extraction Workers	\$57,370	\$36,120	\$68,000
Supervisors - Mechanics, Installers & Repairers	\$54,890	\$35,730	\$64,460
Supervisors - Production & Operating Workers	\$51,020	\$33,370	\$59,840
Aircraft Cargo Handling Supervisors	\$34,970	\$21,980	\$41,460
Supervisors - Helpers, Laborers & Material Movers, Hand	\$45,040	\$28,620	\$53,260
Supervisors - Trans. & Material-Moving Machine/Vehicle Oprs	\$51,540	\$32,420	\$61,110

Training, Other Qualifications and Advancement

When choosing a supervisor, employers look for well-rounded workers who are knowledgeable and organized. Those who are able to motivate employees, maintain morale and command respect have the best advancement opportunities. Strong communication and interpersonal skills are extremely important attributes.

Although the minimum educational requirement is a high school diploma, many organizations prefer to promote applicants with post-secondary technical degrees. In fact, supervisors in highly technological industries may need a bachelor's degree. Regardless of their previous education, workers receive additional training in human resources, computer software, and management before advancing into a supervisory position.

Training requirements for advanced opportunities beyond a supervisory level differ by industry. Supervisors in manufacturing companies usually need a business or engineering degree and in-house training to advance to department head or production manager. In the construction industry, a degree in construction management or engineering is often needed to become a project manager, operations manager, or general superintendent. Some blue-collar worker supervisors eventually open their own businesses.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of blue-collar supervisors include those who supervise professional, technical, sales, clerical, and service workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Management Association, 1601 Broadway, New York, NY 10019. Internet: <http://www.amanet.org>
- National Management Association, 2210 Arbor Blvd., Dayton, OH 45439. Internet: <http://www.nma1.org>
- American Institute of Constructors, 466 94th Ave. N., St. Petersburg, FL 33702. Internet: <http://www.aicnet.org>

Drafters

SOC CODES: 17-3011, 17-3012 and 17-3013

Significant Points

- Opportunities should be best for those with formal training and experience using CAD systems.
- Employers are most interested in applicants who have completed postsecondary school training.
- Voluntary certification is available.

Nature of the Work

- Drafters prepare technical drawings that are used by production and construction workers to build everything from manufactured products to structures. Their drawings specify dimensions, materials to be used, and which procedures to follow.
- Most drafters now use computer-aided drafting (CAD) systems to prepare drawings. This tool allows drawings to be stored electronically so that revisions or duplications can be made easily. However, manual drafting may still be used for certain applications.
- As CAD technology advances and the cost continues to fall, it is likely that almost all drafters will use CAD systems on a regular basis in the future.
- Drafting work has many specializations and titles may denote a particular discipline.

Architectural drafters draw structural features of buildings and other structures. They may specialize by the type of structure or material used.

Aeronautical drafters prepare engineering drawings used in the manufacture of aircraft, missiles, and parts.

Electrical drafters prepare wiring and layout diagrams used by workers who erect, install, and repair electrical equipment and wiring.

Electronic drafters draw wiring diagrams, circuit board assembly diagrams, schematics, and layout drawings used in the manufacture, installation, and repair of electronic devices and components.

Civil drafters prepare drawings and maps used in major construction or civil engineering projects.

Mechanical drafters prepare detail and assembly drawings of machinery and mechanical devices.

Process piping or pipeline drafters prepare drawings used for layout, construction, and operation of oil and gas fields, refineries, chemical plants, and process piping systems.

Working Conditions

- Drafters usually work in comfortable offices furnished to accommodate their tasks. They may sit at adjustable drawing boards or drafting tables when doing manual drawings.
- Because they spend most of their time working on computers, drafters are susceptible to eyestrain, back discomfort, and hand and wrist problems.

Employment

- Drafters held about 230,000 jobs in 2004 in the United States and approximately 11,160 jobs in Pennsylvania.
- Almost 45 percent worked in engineering service firms that do drafting work on a contract basis. Others were employed in manufacturing industries.

Job Outlook

- Employment of drafters in Pennsylvania is expected to decrease from approximately 11,160 in 2004 to approximately 10,370 in 2014. About 314 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Although industrial growth and increasingly complex design problems will increase the demand for drafting services, the increased use of CAD systems should offset this growth.
- Opportunities should be best for individuals who have at least two years of postsecondary training and considerable experience using CAD systems.

Earnings

- In Pennsylvania, drafters averaged \$39,700 to \$45,600 annually in 2005. Entry-level drafters earned between \$27,700 and \$29,800, while experienced drafters earned anywhere from \$45,700 to \$53,900.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for different drafters in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Architectural & Civil Drafters	\$39,740	\$27,750	\$45,730
Electrical & Electronics Drafters	\$45,540	\$28,990	\$53,810
Mechanical Drafters	\$45,240	\$29,720	\$53,000

Training, Other Qualifications and Advancement

Employers are most interested in applicants who have completed postsecondary training in drafting and acquired a solid background in computer-aided drafting and design (CADD) techniques.

Individuals planning a career in drafting should take courses in computer technology, math, science, design, and computer graphics. Mechanical and visual aptitude is important. Aspiring drafters should be able to draw freehand and do detailed work accurately and neatly. In addition, they should have good interpersonal, communication, and problem-solving skills.

Many public and private schools provide training programs in drafting. However, prospective students should be careful in selecting a program, as the kind and quality varies considerably. Technical training obtained in the Armed Forces is highly rated, although some additional training may be required for civilian drafting jobs.

Entry-level or junior drafters perform routine work under close supervision. After gaining experience, junior drafters progress to more difficult work with less supervision. They may be required to exercise more judgment and perform calculations when preparing and modifying drawings. Many employers will pay for continuing education courses for their experienced drafters.

The American Design Drafting Association (ADDA) has established a voluntary certification program for drafters. Although most employers do not require certification, it demonstrates that nationally recognized standards have been met. Individuals who wish to become certified must pass the Drafter Certification Test, which evaluates knowledge and understanding of basic drafting concepts.

Experienced drafters may advance to senior drafter, designer or supervisory positions. With appropriate education, some workers become engineering technicians, engineers or architects. A few drafters go into business for themselves.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of drafters include architects, landscape architects, designers, engineers, engineering technicians, surveyors, cartographers, and science technicians.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201. Internet: <http://www.accsct.org>
- American Design Drafting Association, 105 E. Main St., Newbern, TN 38059. Internet: <http://www.adda.org>

Handlers, Equipment Cleaners, Helpers & Laborers

SOC CODES: 47-2061, 47-3011, 47-3012, 47-3013, 47-3014, 47-3015, 47-3016, 47-5081, 49-9098, 51-9198, 53-6021, 53-6031, 53-7061, 53-7062, 53-7063, 53-7064 and 53-7081

Significant Points

- Most jobs are entry-level and require no formal training.
- Projected employment growth varies by occupation.

Nature of the Work

- Handlers, equipment cleaners, helpers, and laborers (called general laborers going forward) perform tasks that are needed to make the work of skilled construction, maintenance, and production workers flow smoothly.
- To perform their jobs effectively, general laborers must be familiar with the work of those they are assisting.

Construction craft laborers provide much of the physically demanding labor at construction sites. They may prepare sites, dig trenches, mix concrete, or set explosives.

Freight, stock, and material movers use forklifts, dollies, carts, and manual power to move materials between storage and production areas.

Hand packers and packagers manually pack, package, or wrap a variety of materials. They may inspect items, label cartons, and stack packages.

Helpers assist skilled workers. They may fetch tools, hold materials, or clean work areas.

Machine feeders and offbearers are responsible for feeding or removing materials from machines.

Parking lot attendants assist customers in parking their cars and collect parking fees.

Refuse and recyclable material collectors gather trash, garbage, and recyclables from homes and businesses along a regularly scheduled route. They also transport the refuse to the dump, landfill, or recycling center.

Service station attendants fill fuel tanks and wash windshields on vehicles. They may perform simple repairs under the direction of a mechanic.

Vehicle washers and equipment cleaners use water and various cleaning equipment to maintain machinery, vehicles, storage tanks, pipelines, and similar equipment.

Working Conditions

- Although work schedules vary with industry, most general laborers work 8-hour shifts. Early morning, evening, and “graveyard” shifts are common.
- General laborers do repetitive, physically demanding work. They may work at great heights or in tight, awkward places. Some laborers work outdoors in all weather conditions.
- These employees wear safety clothing and hard hats to avoid against injury. Because they may be exposed to harmful materials or chemicals, some workers wear protective devices over their eyes, mouth, and ears.

Employment

- General laborers held about 6.2 million jobs in 2004 in the United States and approximately 253,580 jobs in Pennsylvania.
- Nearly one-quarter worked for manufacturing companies. About 18 percent were employed in the construction industry and roughly 17 percent in service-providing establishments.
- The following table includes the industry groups that employed the most general laborers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	60,170	23.7%
Construction	44,660	17.6%
Services	41,910	16.5%
Retail Trade	36,600	14.4%
Transportation & Warehousing	27,800	11.0%

Job Outlook

- Employment of general laborers in Pennsylvania is expected to decrease from approximately 253,580 in 2004 to approximately 252,670 in 2014. About 7,425 annual openings will result from replacement needs. Although no net employment growth is expected for general laborers, growth openings may occur in some specific occupations and certain regions.
- Equipment cleaners, hand packers, parking lot attendants, construction helpers, and refuse material collectors will have the best employment prospects. Service station attendants and machine feeders can expect declines in employment levels.
- Employment growth will be limited by automation, out-sourcing, and job combination. All of these factors increase productivity and improve quality control. As a result, many jobs will be eliminated.

Earnings

- In Pennsylvania, general laborers averaged \$8.30 to \$15.10 per hour in 2005. Entry-level rates were between \$6.00 and \$9.40 per hour, while experienced laborers earned anywhere from \$9.40 to \$18.00 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for general laborers in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Construction Laborers	\$15.06	\$9.36	\$17.91
Helpers--Brick, Block & Stonemasons and Tile & Marble Setters	\$13.33	\$9.11	\$15.44
Helpers--Carpenters	\$10.93	\$8.29	\$12.25
Helpers--Electricians	\$12.52	\$8.08	\$14.74
Helpers--Painters, Paperhangers, Plasterers & Stucco Masons	\$11.30	\$7.61	\$13.15
Helpers--Pipelayers, Plumbers, Pipefitters & Steamfitters	\$12.00	\$8.71	\$13.65
Helpers--Roofers	\$10.85	\$7.88	\$12.34
Helpers--Extraction Workers	\$13.02	\$8.59	\$15.23
Helpers--Installation, Maintenance & Repair Workers	\$11.29	\$7.36	\$13.26
Helpers--Production Workers	\$11.40	\$7.74	\$13.23
Parking Lot Attendants	\$8.34	\$6.19	\$9.42
Service Station Attendants	\$8.32	\$6.00	\$9.48
Cleaners of Vehicles & Equipment	\$8.92	\$6.32	\$10.22
Laborers & Freight, Stock & Material Movers, Hand	\$11.61	\$7.65	\$13.59
Machine Feeders & Offbearers	\$12.07	\$8.29	\$13.97
Packers & Packagers, Hand	\$10.10	\$6.99	\$11.65
Refuse & Recyclable Material Collectors	\$13.82	\$8.63	\$16.41

Training, Other Qualifications and Advancement

Most general laborer positions are entry-level and do not require a high school diploma or any previous experience. However, most employers prefer to hire those who are at least 18 years old and physically able to perform the work. Applicants may have to take a physical exam, pass a drug test, or undergo a background check prior to employment.

Workers must be reliable and hard working. Basic reading and math skills are needed to understand procedure manuals and collect payments from customers. Grocery store baggers, service station workers, and parking lot attendants should be pleasant and courteous when dealing with the public.

Although most general laborers learn their skills through on-the-job training, formal apprenticeship programs are available in construction trades. These programs, which combine on-the-job training with classroom instruction, provide overall preparation. Apprentices are taught how to properly handle all tools and equipment.

Before an apprentice is placed on the job, most union contractors require some hands-on training. Likewise, workers who must handle toxic chemicals or operate dangerous equipment often receive additional training in safety awareness and procedures.

Experienced laborers often become trainees for skilled construction, maintenance, and production positions. In fact, most employers prefer to fill open slots with qualified workers from within the company. Some general laborers are promoted to supervisory positions.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of general laborers include roustabouts, forest workers, logging equipment operators, and groundskeepers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Carwash Association, 401 N. Michigan Ave., Chicago, IL 60611.
Internet: <http://www.carwashes.com>

Industrial Production Managers

SOC CODE: 11-3051

Significant Points

- Applicants with a college degree should enjoy the best job prospects.
- Over 80 percent were employed in manufacturing industries.

Nature of the Work

- **Industrial production managers** coordinate the resources and activities required to produce goods. Their primary responsibility is planning the production schedule within budgetary limitations and time constraints. Other duties include staffing, quality control, and inventory control.
- Managers work closely with heads of other departments to plan and implement company goals, policies, and procedures. Computers are important in this coordination and in providing up-to-date information on inventory, work progress, and quality standards.
- Because industrial production managers usually report to the plant manager or vice president of manufacturing, they often act as liaison between executives and first-line supervisors.
- In many plants, one manager is responsible for all aspects of production. However, in large plants, there are usually managers in charge of each operation.

Working Conditions

- Industrial production managers usually work more than 40 hours a week. In facilities that operate around the clock, they often work late shifts. Managers are always on-call, in case of emergencies.
- Most managers divide their time between the shop floor and their offices. While on the shop floor, they must follow established health and safety practices and wear the required protective clothing and equipment.
- Working under the pressure of production deadlines or emergency situations can be stressful. Restructuring has eliminated levels of management and support staff, which shifts more responsibilities to production managers and compounds this stress.

Employment

- Industrial production managers held about 160,300 jobs in 2004 in the United States and approximately 9,370 jobs in Pennsylvania.
- Although employed throughout the manufacturing sector, most were employed in firms that produce paper products, drugs, plastic products, electronic components, and fabricated metal products.

Job Outlook

- Employment of industrial production managers in Pennsylvania is expected to decrease from approximately 9,370 in 2004 to approximately 9,170 in 2014. About 181 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Job prospects should be best for individuals with a college degree in industrial engineering, management, or business administration. Applicants with a master's degree in business administration (MBA) may have even more opportunities.
- Growing productivity and organizational restructuring will limit the demand for industrial production managers.

Earnings

Average annual earnings of industrial production managers in Pennsylvania were \$86,040 in 2005. The entry-level wage in 2005 was \$49,450 while an experienced industrial production manager made \$104,340.

Training, Other Qualifications and Advancement

Because of the diversity of manufacturing operations and job requirements, there is no standard preparation for this occupation. Many industrial production managers have a college degree in business administration, management or industrial engineering, although some companies will hire well-rounded liberal arts graduates. Others are promoted from supervisor positions. As production operations become more sophisticated, more employers are looking for candidates with master's degrees in business administration.

Those who enter the field directly after school may spend their first few months in the company's training program. These programs familiarize trainees with the production line, company policies, and the requirements of the job. In larger companies, they may also include assignments to other departments.

Successful managers must be well-rounded individuals that have excellent communication skills. The ability to compromise, persuade and negotiate with workers and other managers is essential. In addition, many industrial production managers belong to professional organizations, which sponsor trade shows, industry conferences, and conventions. At these meetings, new equipment is displayed, changes in production methods are discussed, and managers are made aware of technological advances.

Industrial production managers with a proven record of superior performance may be promoted to plant manager or vice president of manufacturing. Others transfer to larger firms for jobs with more responsibilities. A few become independent consultants.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of industrial production managers include materials managers, operations managers, purchasing managers, transportation managers, sales engineers, manufacturer's sales representatives, materials engineers, and industrial engineers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- National Management Association, 2210 Arbor Blvd., Dayton, OH 45439. Internet: <http://www.nma1.org>
- American Management Association, 1601 Broadway, 10th Floor, New York, NY 10019. Internet: <http://www.amanet.org>

Inspectors, Testers, Sorters, Samplers & Weighers

SOC CODES: 51-9061

Significant Points

- Automation will dampen employment growth in certain industries.
- Training requirements vary with job responsibilities.

Nature of the Work

- *Inspectors, testers, sorters, samplers, and weighers* use a number of tools to monitor quality standards for manufactured products. They may use sight, sound, feel, smell, or taste to check products.
- Quality checks are involved at every stage of the production process. *Quality control inspectors*, as they are otherwise known, may examine raw materials, subassemblies, or finished products.
- After problems have been identified, quality control inspectors may reject defective items, send them for repair, or fix minor problems themselves. They record results, compute defect percentages, and prepare reports.

Working Conditions

- Quality control inspectors may work daylight, evening, or weekend shifts. Work schedules are typically assigned based on seniority. Overtime may be required to meet production goals.
- Shifts may be spent examining similar products or a variety of items.
- Work environments range from clean, air-conditioned rooms to noisy, grimy manufacturing plants.
- Some quality control inspectors spend all day on their feet and are expected to lift heavy objects. Others sit through their shifts and do little strenuous work.

Employment

- Quality control inspectors held about 507,600 jobs in 2004 in the United States and approximately 22,710 jobs in Pennsylvania.
- Almost 71 percent were employed with manufacturing establishments. Others worked for service-providing firms, wholesalers and government agencies.
- The following table includes the industry groups that employed the most quality control inspectors in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	16,110	70.9%
Services	3,440	15.1%
Wholesale & Retail Trade	1,090	4.8%
Government	1,050	4.6%

Job Outlook

- Employment of quality control inspectors in Pennsylvania is expected to decrease from approximately 22,710 in 2004 to approximately 20,610 in 2014. About 517 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Automated inspection and the re-distribution of quality control responsibilities will dampen employment growth. However, automation is not being pursued in all industries.
- Employment levels are expected to increase the most in fast-growing industries, such as wholesale trade and business services.
- Job openings should be plentiful because this is a large occupation with significant turnover. Many jobs, however, will be available only to experienced production workers with advanced skills.

Earnings

Average hourly earnings of quality control inspectors in Pennsylvania were \$15.74 in 2005. The entry-level rate for a quality control inspector in 2005 was \$9.97 while an experienced inspector made \$18.62.

Training, Other Qualifications and Advancement

Quality control inspectors need mechanical aptitude, strong math skills, good hand-eye coordination, and good eyesight. Most employers prefer workers who have a high school diploma. For some jobs, a diploma is mandatory. Additional training requirements vary with the responsibilities of the inspector. In fact, many organizations provide in-house training for their quality control inspectors. These in-house training programs cover instrument use, quality control techniques, safety, blueprint reading, and reporting requirements.

Most employers choose to fill inspector positions with experienced assemblers, machine operators, or mechanics. Workers who enter these positions may need additional training in statistical process control, new automation, and the company's quality assurance policies. As automated inspection equipment becomes more common, computer skills are increasingly important.

Advancement opportunities usually take the form of higher pay and more responsibility. Some quality control inspectors are promoted to supervisory positions. Others take related positions, such as materials or equipment purchaser.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of quality control inspectors include construction inspectors, building inspectors, and compliance officers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- The American Society for Quality, PO Box 3005, Milwaukee, WI 53201-3005. Internet: <http://www.asq.org>

Machinists

SOC CODES: 51-4011, 51-4012 and 51-4041

Significant Points

- Job opportunities should be excellent for skilled workers.
- Previous experience with machine tools is very important.

Nature of the Work

- **Machinists** use tools, such as lathes and drill presses, to produce and repair precision metal parts. Thorough planning and preparation must be completed before any parts are cut.
- Many of today's machine tools are computer numerically controlled (CNC). They read computer programs and run the production mechanism automatically. Workers who program these machines are often referred to as **numerical control machine tool programmers** or **CNC programmers**.
- CNC machines enable higher productivity and better quality parts. However, the quality of the product largely depends on the operating program. New programs must be tested to ensure that machinery will function properly and that output will meet specifications.

Working Conditions

- Most machinists work a 40-hour week. Evening and weekend shifts are becoming more common as companies extend their hours of operation. Overtime may be required during peak production periods.
- Machinists usually work in well-lit, well-ventilated machine shops. On the other hand, CNC programmers work in clean, quiet offices that are separate from the shop floor.
- Because they spend most of their day standing and lifting heavy equipment, machinists need a lot of stamina.
- Protective equipment such as safety glasses and earplugs are usually worn. Extra caution must be taken when handling hazardous coolants and lubricants.

Employment

- Machinists held about 512,800 jobs in 2004 in the United States and around 25,920 jobs in Pennsylvania.
- Over 88 percent worked in manufacturing firms that produce durable goods, such as metalworking machinery, fabricated metal products and general industrial machinery.
- The following table includes the industries that employed the most machinists in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Machine Shops & Threaded Products	6,260	24.1%
Metalworking Machinery Manufacturing	2,340	9.0%
Other Fabricated Metal Product Mfg	1,470	5.7%
Plastics Product Manufacturing	1,130	4.4%

Job Outlook

- Employment of machinists in Pennsylvania is expected to decrease from approximately 25,920 in 2005 to approximately 25,680 in 2014. About 544 annual openings will result from replacement needs. Although no net employment growth is expected, growth openings may occur in some areas.
- Job opportunities should be excellent as employers continue to report difficulties in finding workers with the necessary skills and knowledge to fill openings.
- Rising productivity will limit employment growth. The increased use of computer-controlled machinery and other new technologies allow fewer machinists to accomplish the same amount of work.
- Employment levels are influenced by economic cycles. During slow economic periods, machinists and CNC programmers may be laid off or forced to work fewer hours. However, proper maintenance and repair work is vital and machinists involved in plant maintenance often have more stable employment.

Earnings

- Overall, numerical tool and process control programmers earned the highest wages at all levels of experience. Computer-controlled machine tool operators had the lowest wages across all levels of experience.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for different machinists in Pennsylvania.

Occupational Title	Average Annual Wage	Entry Level Wage	Experienced Level Wage
Computer-Controlled Machine Tool Operators	\$31,960	\$21,840	\$37,020
Numerical Tool & Process Control Programmers	\$46,690	\$28,810	\$55,640
Machinists	\$34,330	\$24,290	\$39,360

Training, Other Qualifications and Advancement

Employers prefer to hire machinists with a high school or vocational school education. For specialized programs, a degree in engineering may be required. Aspiring machinists should be mechanically inclined and able to work independently. Basic knowledge of computers and electronics is also helpful. Previous experience with machine tools is very important. In fact, many machinists and numerical control machine tool programmers have previously worked as machine tool operators or setters.

Some machinists participate in apprenticeship programs, which consist of hands-on training and related classroom instruction. In addition, increased training in the operation and programming of CNC machine tools has become essential. However, formal apprenticeship programs are relatively rare. Most machinists receive their training from community colleges or technical schools.

To create a uniform standard of competency, many training facilities have redesigned their curriculums to incorporate the national skills standards that were developed by the National Institute of Metalworking Skills (NIMS). A NIMS credential is awarded to graduates who pass the performance requirement and written examination. This designation provides formal recognition of competency in the metalworking field and can lead to advancement or improved job opportunities.

Qualifications for CNC programmers can vary widely depending on the complexity of the job. Under the direction of an experienced programmer, trainees start with simple programs. There are numerous programming languages and CNC programmers must be able to learn new ones.

As new automation is introduced, machinists and CNC programmers receive additional training to update their skills. In addition, some employers offer tuition reimbursement for job-related courses.

Machinists can advance in several ways. Experienced workers may become CNC programmers. Some are promoted to supervisory or administrative positions. A few open their own shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of machinists include tool and die makers, metalworking machine operators, plastics-working machine operators, tool planners, instrument makers, blacksmiths, gunsmiths, locksmiths, metal patternmakers, welders, and computer programmers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- The Precision Machined Products Association, 6700 W. Snowville Rd., Brecksville, OH 44141.
Internet: <http://www.pmpa.org>
- National Tooling and Machining Association, 9300 Livingston Rd., Fort Washington, MD 20744.
Internet: <http://www.ntma.org>
- PMA Educational Foundation, 6363 Oak Tree Blvd., Independence, OH 44131.
Internet: <http://www.pmaef.org>

Metal & Plastics Machine Operators

SOC CODES: 51-4021, 51-4022, 51-4023, 51-4031, 51-4032, 51-4033, 51-4034, 51-4035, 51-4051, 51-4052, 51-4061, 51-4062, 51-4071, 51-4072, 51-4081, 51-4191, 51-4192, 51-4193, 51-4194 and 51-4199

Significant Points

- Skills are acquired through on-the-job training.
- Demand will be higher in the plastics industries.
- Lower-skilled positions will likely be eliminated by automated technologies.

Nature of the Work

- Metal & plastics machine operators use a variety of machines to produce metal and plastic items, which are used in many consumer products. Some specialize in a single type of machinery.
 - Metalworking machine operators* use machines to cut and form metal parts. Operators may watch more than one machine and make minor adjustments as needed.
 - Plastic-working machine operators* tend machines that transform plastic compounds into consumer goods. Production methods include injection molding, blow molding, and extrusion. Operators also load raw materials, make minor adjustments, and inspect the final products.
- Operators are generally broken into two groups – setters and tenders. Setters prepare machines for operation and tenders monitor the machinery during operation. Tenders may also load or unload the machines and make minor adjustments to the controls.
- Computer numerically controlled (CNC) machines are increasingly used in metalworking operations. Although CNC machines operate automatically, a CNC machine tool operator ensures proper set-up and usage. These operators have less hands-on interaction with the machinery than manual machine tool operators.

Working Conditions

- Most metal & plastics machine operators work a 40-hour week, including night and weekend shifts. Overtime work is common during peak production periods.
- Work areas are usually clean, well-lit, and well ventilated. Operators stand for much of the day and may lift heavy equipment.
- Protective equipment, such as safety glasses and earplugs, is usually worn.

Employment

- Metal & plastics machine operators held about 1.1 million jobs in 2004 in the United States and approximately 57,350 jobs in Pennsylvania.
- Almost 92 percent were employed with manufacturing firms, including companies that produce plastic, blast furnace, and fabricated metal products. A few were employed through temporary help agencies.

Job Outlook

- Employment of metal & plastics machine operators in Pennsylvania is expected to decrease from approximately 57,350 in 2004 to approximately 50,400 in 2014. About 1,231 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Lower-skilled positions are more likely to be eliminated by automated technologies. As a result, manual machine operators can expect declines in employment.
- As plastic products are increasingly substituted for metal goods, employment levels for machine operators will respond accordingly.
- Workers with a diverse background in machine operation and thorough knowledge of material properties should be best suited to adjust to the changing environment.

Earnings

- In Pennsylvania, metal & plastics machine operators averaged between \$13.10 and \$17.80 hourly in 2005. Entry-level workers earned between \$8.50 and \$12.80, while experienced metal & plastics machine operators were paid anywhere from \$14.50 to \$20.90.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different metal & plastics machine worker occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Extruding & Drawing Machine Setters/Oprs/Tenders	\$15.25	\$11.08	\$17.34
Forging Machine Setters/Oprs/Tenders	\$13.97	\$9.95	\$15.99
Rolling Machine Setters/Oprs/Tenders	\$15.21	\$10.91	\$17.36
Cutting, Punching & Press Machine Setters/Oprs/Tenders	\$13.56	\$9.64	\$15.52
Drilling & Boring Machine Tool Setters/Oprs/Tenders	\$15.62	\$10.38	\$18.24
Grinding, Lapping, Polishing & Buffing Machine Tool Setters/Oprs/Tenders	\$15.29	\$10.36	\$17.75
Lathe & Turning Machine Tool Setters/Oprs/Tenders	\$16.47	\$12.71	\$18.35
Milling & Planing Machine Setters/Oprs/Tenders	\$16.30	\$11.12	\$18.88
Metal-Refining Furnace Operators/Tenders	\$16.98	\$11.44	\$19.75
Pourers & Casters, Metal	\$14.58	\$10.58	\$16.59
Model Makers	\$14.39	\$8.56	\$17.30
Patternmakers	\$15.21	\$9.60	\$18.01
Foundry Mold & Coremakers	\$13.16	\$10.42	\$14.53
Molding & Casting Machine Setters/Oprs/Tenders	\$13.50	\$9.70	\$15.40
Multiple Machine Tool Setters/Oprs/Tenders	\$14.96	\$10.80	\$17.04
Heat Treating Equipment Setters/Oprs/Tenders	\$15.40	\$10.77	\$17.71
Lay-Out Workers	\$15.56	\$12.01	\$17.33
Plating & Coating Machine Setters/Oprs/Tenders	\$14.73	\$10.81	\$16.69
Tool Grinders, Filers & Sharpeners	\$15.14	\$10.48	\$17.48
Metal Workers & Plastic Workers, Other	\$17.71	\$11.42	\$20.86

Training, Other Qualifications and Advancement

Metal & plastics machine operators generally learn their skills through on-the-job training. After observing and assisting experienced workers, trainees become responsible for their own machines. Although most operators learn basic machine operations in just a few weeks, several years may be needed to become skilled machine operators. CNC machine tool operators, who are expected to run programs, may receive formal courses from machine manufacturers or technical schools.

Some companies offer formal training programs, which combine on-the-job training with classroom instruction, for their set-up operators. Set-up operators often plan the work sequence, make the first production run, and determine which adjustments need to be made. Because their work is vital to the production process, set-up operators must have strong analytical abilities and a thorough knowledge of the machinery.

Employers prefer to hire high school graduates who are able to read, write, and speak English. Good communication and interpersonal skills are also very important. Mechanical aptitude, manual dexterity, and previous machinery experience are also helpful. Aspiring machine operators can improve their employment opportunities by gaining a working knowledge of the properties of metals and plastics. High school courses in shop and blueprint reading are beneficial.

The National Institute for Metalworking Skills (NITS) has developed certification standards for metalworking machine operators. Graduates of NITS approved courses may be issued formal certification after meeting performance requirements and passing a written examination. Likewise, the Society of Plastics Industry certifies experienced plastics-working machine operators who pass a computer-based exam.

Advancement opportunities usually take the form of higher pay. Manual machine operators can become CNC equipment operators or advance to supervisory positions. CNC operators with substantial programming training can take positions as numerical control machine tool programmers.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of metal & plastics machine operators include machinists, tool and die makers, woodworking machine operators, and metal patternmakers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- The Precision Machined Products Association, 6700 W. Snowville Rd., Brecksville, OH 44141.
Internet: <http://www.pmpa.org>
- The Society of Plastics Industry, 1801 K St. NW, Suite 600, Washington, DC 20006.
Internet: <http://www.socplas.org>
- National Tooling and Metalworking Association, 9300 Livingston Rd., Fort Washington, MD 20744.
Internet: <http://www.ntma.org>
- PMA Educational Foundation, 6363 Oak Tree Blvd., Independence, OH 44131.
Internet: <http://www.pmaef.org>

Painting & Coating Workers

SOC CODES: 51-9121, 51-9122 and 51-9123

Significant Points

- Job prospects should be best for skilled workers with vocational school training.
- Basic skills are acquired through on-the-job training.
- Voluntary certification is available for experienced automotive painters.

Nature of the Work

- Painting and coating workers control the machinery that applies paints and coatings to a wide range of manufactured products. Different workers use different painting and coating techniques.

Dippers immerse articles in vats of paint, liquid plastic, or other solutions.

Tumbling barrel painters deposit articles made of porous materials into a rotating barrel of coating.

Spray-machine operators use spray guns to coat products with paint and other coating solutions. Among the most highly skilled spray-machine operators are *automotive or transportation equipment painters*, who perform intricate work and mix paints to match the original color.

Workers who paint, coat, or decorate articles such as furniture, glass, pottery, toys, and books are known as *painting, coating and decorating workers*.

- In response to environmental and safety concerns, new paints and coatings are being used by manufacturers. Water-based paints and powder coatings are two of the most common.
- The adoption of new paints and coatings is often accompanied by a conversion to more automated equipment, which a machine operator can set and monitor.

Working Conditions

- Painting and coating workers normally work a 40-hour week. Self-employed automotive painters may work more than 50 hours per week.
- Operators usually stand for long periods of time. They may have to bend, stoop, or crouch to reach different parts of the item.
- Although most painting is done in specially ventilated booths, masks, or respirators are usually worn to protect against dangerous paint and coating solution fumes.

Employment

- Painting and coating workers held about 185,500 jobs in 2004 in the United States and approximately 7,190 jobs in Pennsylvania.
- Over 76 percent were employed with manufacturing companies, including those that produce furniture, fabricated metal products, railroad equipment or construction machinery. Another 11 percent worked in automotive body repair shops.

Job Outlook

- Employment of painting and coating workers in Pennsylvania is expected to decrease from approximately 7,190 in 2004 to approximately 6,970 in 2014. About 187 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- A growing population demands more manufactured goods and will, in turn, stimulate employment growth. This growth will be limited by improvements in automation and increased worker productivity. However, the detailed work of automotive refinishers does not easily lend itself to automation.
- Job prospects will be best for skilled automotive painters and those with vocational school training.
- Painting and coating workers may be affected by cyclical changes in economic conditions. When the demand for manufactured goods decreases, these workers may face reduced hours or even be laid off.

Earnings

- Average hourly earnings of coating, painting & spraying machine workers in Pennsylvania were \$15.54 in 2005. The entry-level rate in 2005 was \$10.93 while experienced coating, painting & spraying machine workers made \$17.84.
- Average hourly earnings of transportation equipment painters in Pennsylvania were \$17.25 in 2005. The entry-level rate in 2005 was \$12.55 while an experienced transportation equipment painter made \$19.61.

- Average hourly earnings of painting, coating & decorating workers in Pennsylvania were \$12.63 in 2005. The entry-level rate in 2005 was \$8.58 while an experienced painting, coating & decorating worker made \$14.65.
- Many automotive painters receive a commission in addition to their minimum weekly salary. Under this method, earnings depend largely on the amount of work that is completed.

Training, Other Qualifications and Advancement

Most painting and coating workers acquire basic skills by observing and assisting experienced workers. This training process can last anywhere from a few days to several months. Skilled automotive painters may undergo up to two years of on-the-job training. Those who modify computer-controlled equipment may require additional training in computer operations and programming.

To increase worker productivity, some employers sponsor additional training programs, which include information on safety and product quality. Automotive painters may be sent to technical schools to learn about mixing and applying different types of paint.

The National Institute for Automotive Service Excellence (ASE) offers voluntary certification for automotive painters with two years of practical experience. Related training may be substituted for up to 1 year of experience. Qualified workers must then pass the written examination in order to become certified. To maintain certification, painters must retake the examination every five years.

Keen eyesight and a good sense of color are important to all painting and coating workers. Although a high school diploma is not usually required, it may be advantageous. Community college and vocational-technical school programs can also enhance one's employment prospects.

Painting and coating workers may advance to team leader or supervisor positions. With formal training, some take positions as sales representatives. Experienced automotive painters may open their own shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of painting and coating workers include painters of construction equipment and woodworkers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- National Institute for Automotive Service Excellence (ASE), 101 Blue Seal Dr. SE, Leesburg, VA 20175. Internet: <http://www.asecert.org>

Precision Assemblers

SOC CODES: 51-2011, 51-2021, 51-2022, 51-2023, 51-2031, 51-2041, 51-2091, 51-2092, 51-2093 and 51-2099

Significant Points

- Increased automation and internationalization will dampen employment growth.
- Virtually all assemblers worked in plants that manufacture durable goods.

Nature of the Work

- ***Precision assemblers*** perform a series of complex tasks to produce intricate manufactured products, such as aircraft, automobiles, computers, and small electrical components. Individuals may work on subassemblies or the finished product.
- Product development specialists interpret engineering specifications from text, drawings, and computer-aided drafting systems. They may work with engineers and technicians to assemble prototypes or test products.
- As technology changes, so does the nature of the manufacturing process. Flexible manufacturing systems change the way goods are made and affect the jobs of precision assemblers.

Working Conditions

- Most precision assemblers work a 40-hour week, although overtime is fairly common. Work schedules may vary at plants where more than one shift is worked.
- Long periods of time are spent sitting or standing in one place.
- The increased use of robotics and other pneumatically powered machinery has improved working conditions by lowering the overall noise level at many facilities.

Employment

- Precision assemblers held about 2.0 million jobs in 2004 in the United States and approximately 77,020 jobs in Pennsylvania.
- Over 82 percent worked for companies that manufacture durable goods, such as plastic products, electronic components, motor vehicle bodies and laboratory instruments.

Job Outlook

- Employment of precision assemblers in Pennsylvania is expected to decrease from approximately 77,020 in 2004 to approximately 74,950 in 2014. About 2,018 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- The increased use of robotics is expected to raise the productivity of assembly workers but adversely affect the employment level. These effects will be less severe in some industries than in others.
- Manufacturing companies often send their subassembly or component production functions to countries where labor costs are lower. This growing internationalization of production will lead to growth in goods exportation and the creation of jobs in other industries.

Earnings

- In Pennsylvania, precision assemblers averaged \$12.30 to \$15.60 per hour in 2005. Entry-level rates were between \$8.40 and \$11.10 per hour, while experienced precision assemblers earned anywhere from \$14.30 to \$17.90 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different precision assembler occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Aircraft Structure, Surfaces, Rigging & Systems Assemblers	N/A	N/A	N/A
Coil Winders, Tapers & Finishers	\$14.34	\$10.50	\$16.25
Electrical & Electronic Equipment Assemblers	\$13.62	\$8.87	\$16.00
Electromechanical Equipment Assemblers	\$15.53	\$10.96	\$17.82
Engine & Other Machine Assemblers	\$15.25	\$10.61	\$17.58
Structural Metal Fabricators & Fitters	\$15.23	\$11.09	\$17.30
Fiberglass Laminators & Fabricators	\$13.15	\$9.75	\$14.86
Team Assemblers	\$12.35	\$8.41	\$14.31
Timing Device Assemblers, Adjusters & Calibrators	\$13.80	\$10.31	\$15.55
Assemblers & Fabricators, Other	\$14.15	\$8.70	\$16.87

- No Pennsylvania-specific wage information was available for aircraft structure, surfaces, rigging & systems assemblers. However, the national average hourly earnings of aircraft assemblers were \$20.45 in 2005.

Training, Other Qualifications and Advancement

Most precision assemblers are promoted from lesser skilled jobs within the company. Employees learn about the broad range of duties they may be required to perform through extensive on-the-job training or classroom instruction. Some jobs require specialized training, which is offered in technical schools and the Armed Forces.

Precision assemblers must be able to perform accurate work at a rapid pace. Manual dexterity and good eyesight are extremely important qualities when dealing with small parts. In addition, companies may test applicants for accurate color vision. In general, employers prefer to hire or promote high school graduates into entry-level assembler positions.

As assemblers gain experience, they may progress to jobs that require more skill and be given more responsibility. A few qualified assemblers become supervisors. Others take positions in product repair, quality control, or product development.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of precision assemblers include welders, ophthalmic laboratory technicians, and machine operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>

Prepress Technicians & Workers

SOC CODES: 51-5021 and 51-5022

Significant Points

- Most skills are acquired through on-the-job training programs.
- Technological advances have changed the printing industry and may eliminate many prepress jobs.

Nature of the Work

- As the first step in the printing process, prepress workers transform text and pictures into finished pages. Duties and job functions of prepress workers vary.

Preflight technicians edit the work of the desktop publishing specialists to ensure overall quality of the finished product before it is delivered to the customer.

Job printers are responsible for composition, page layout, proofing, editing, and printing.

Camera operators make lithographic plates by photographing the material that is to be printed.

Scanner operators use computerized equipment to create film negatives or positives of photographs or art.

Lithographic dot etchers retouch film by sharpening or reshaping images. They work by hand, using chemicals, dyes, and special tools.

Film strippers cut film to the required size and arrange the negatives onto “flats”, or layout sheets used to make press plates.

Platemakers use a photographic process to make printing plates.

- A growing number of printing plants use lasers to directly convert electronic data to plates without any use of film. Lithographic platemakers must make sure that plates meet quality standards.
- Computers are increasingly used to produce material that looks like the desired product. However, prepress workers are needed for text composition, page layout, and plate making.

Working Conditions

- Most prepress employees work an eight-hour day, including nights, weekends or holidays.
- In general, work areas are clean, air-conditioned and relatively noise-free.
- The pressures of short deadlines and tight work schedules may cause stress.
- Prepress workers may be susceptible to eyestrain and back discomfort. Platemakers must be careful when working with toxic chemicals, which may cause skin irritations.

Employment

- Prepress workers held about 140,600 jobs in 2004 in the United States and around 7,360 jobs in Pennsylvania.
- Over 68 percent worked in the manufacturing sector, mainly with establishments that handle commercial or business printing. Another 18 percent were employed with companies that publish printed products, such as newspapers and books.

Job Outlook

- Employment of prepress workers in Pennsylvania is expected to decrease from approximately 7,360 in 2004 to approximately 7,010 in 2014. About 179 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Technological advances will have varying effects on employment. A decline in prepress machine operators is expected as their duties become automated.
- Although most employers prefer to hire experienced prepress workers, opportunities will exist for inexperienced workers who have post-secondary training in printing technology and strong computer skills.
- Job prospects will be best in advertising agencies, public relations firms and commercial printers.

Earnings

- Average hourly earnings of job printers in Pennsylvania were \$15.10 in 2005. The entry-level rate in 2005 was \$9.40 while an experienced job printer made \$17.95.
- Average hourly earnings of prepress technicians & workers in Pennsylvania were \$15.89 in 2005. The entry-level rate in 2005 was \$10.37 while an experienced prepress worker made \$18.65.

Training, Other Qualifications and Advancement

Most prepress workers acquire their skills through on-the-job training. Helpers learn basic skills from experienced workers and then advance to more complex duties. Although the length of on-the-job training programs can vary by occupation, basic skills are usually learned within a few months.

Although their popularity has decreased, formal apprenticeships are still a good way to learn about all phases of printing. Instead of apprenticeships, many prepress workers elect to attend formal graphic arts programs or community, junior, and some four-year colleges. In addition, printing courses are available through vocational-technical schools, industry-sponsored programs, and private trade schools.

When hiring prepress workers, employers prefer high school graduates who possess strong oral and written communication skills. Workers must have manual dexterity and the ability to pay close attention to detail. In addition, production deadlines require adaptable workers who can work independently. In small establishments, employees must be courteous when dealing with the public. Basic mathematical, electrical, and computer skills are important. Those with artistic abilities may have an advantage.

Experienced workers can advance into positions that require greater responsibility. Some are even promoted to supervisory positions.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of prepress workers include graphic artists, graphic designers, desktop publishers, sign painters, jewelers, decorators, engravers, typists and data entry keyers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Graphic Communications International Union, 1900 L St. NW, Washington, DC 20036.
Internet: <http://www.gciu.org>
- Printing Industries of America. 200 Deer Run Rd., Sewickley, PA 15143. Internet: <http://www.gain.org>
- Graphic Communications Council, 1899 Preston White Dr., Reston, VA 20191.
Internet: <http://www.npes.org/education/index.html>

Printing Machine Operators

SOC CODES: 51-5023

Significant Points

- Skills are usually acquired through on-the-job training.
- Employment growth will be limited by the introduction of computerized printing presses.

Nature of the Work

- **Printing machine operators** are responsible for the preparation, operation, and maintenance of printing presses. Duties vary with the type of press being operated.
- To prepare for printing, operators install the printing plate, adjust the pressure, and ink the presses. Next, they feed the paper through the press cylinders and adjust the feed controls. While the press is running, operators monitor the situation, keep the paper feeders well stocked, and make any necessary adjustments.
- Small commercial shops are usually operated by one person and tend to have relatively small presses, which print only one or two colors at a time. Newspaper, magazine, and book printers tend to operate larger printing presses that require a crew of several operators and assistants.
- Many plants are installing printing presses with computers and sophisticated control instruments. These machines make it possible to set up jobs in less time and adjust the printing process electronically.

Working Conditions

- Most printing machine operators work at least eight-hours a day, including evening and night shifts. Overtime work may be required to meet production deadlines.
- Printing machine operators are on their feet most of the day working in noisy pressrooms. They face pressures to meet deadlines and avoid waste.
- Press machinery can be hazardous. However, computerized equipment allows most adjustments to be made safely from a control panel.

Employment

- Printing machine operators held about 191,200 jobs in 2004 in the United States and approximately 11,190 jobs in Pennsylvania.
- Most were employed with companies that handle commercial or business printing. Additional jobs were found with companies that provide mailing, reproduction, and copying services.
- The following table includes the industries that employed the most printing machine operators in 2002 in Pennsylvania.

Industry	2002 Employment	Percent
Printing & Related Support Activities	5,050	45.1%
Converted Paper Product Manufacturing	1,860	16.7%
Newspaper, Book & Directory Publishers	890	8.0%
Plastics Product Manufacturing	730	6.5%

Job Outlook

- Employment of printing machine operators in Pennsylvania is expected to grow from approximately 11,190 in 2004 to approximately 11,330 in 2014. Printing machine operators can expect about 14 openings due to growth and about 260 replacement openings for approximately 274 total annual openings.
- Although the printing industry is growing, fewer printing machine operators are needed to operate computerized printing presses.
- Opportunities will be best for those who have completed an apprenticeship or some postsecondary training. However, inexperienced workers will likely face keen competition from displaced workers with experience.
- Because they are under severe pressure to meet deadlines and have limited time to train new employees, many employers choose to fill open positions with experienced workers.

Earnings

Average hourly earnings of printing machine operators in Pennsylvania were \$15.91 in 2005. The entry-level rate in 2005 was \$10.46 while an experienced printing machine operator made \$18.64.

Training, Other Qualifications and Advancement

Although apprenticeship and post-secondary programs offer the best all-around training, most printing machine operators learn their skills while working as assistants or helpers to experienced workers. Initially, they are responsible for loading, unloading, and cleaning the printing presses. As they gain experience, they are allowed to operate simple presses and eventually more complex machinery.

Apprenticeship programs, which last about four years and combine classroom instruction with on-the-job training, were once the dominant training method for this occupation. Today, they are less prevalent. In contrast, post-secondary programs are growing in popularity. These programs, which are offered by technical schools and community colleges, can usually be completed in about one year. A few programs last two-years and award an associate degree. The theoretical knowledge obtained through these post-secondary programs allows graduates to operate more advanced equipment.

When hiring printing machine operators, employers look for applicants with strong oral and written communication skills. Basic mathematics and computer knowledge is also important. In addition, printing machine operators must have the mechanical aptitude to make necessary adjustments and repairs. Because of technological advances in the printing industry, those with previous courses in chemistry, electronics, physics, and color theory may have an advantage over other applicants.

Advancement usually takes the form of higher pay and increased responsibilities. However, some printing machine operators advance to pressroom supervisor positions.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of printing machine operators include operators of papermaking, shoemaking, bindery, and various precision machines.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Graphic Communications International Union, 1900 L St. NW, Washington, DC 20036.
Internet: <http://www.gciu.org>
- Graphic Arts Information Network. 200 Deer Run Rd., Sewickley, PA 15143. Internet: <http://www.gain.org>
- Graphic Communications Council, 1899 Preston White Dr., Reston, VA 20191.
Internet: <http://www.npes.org/education/index.html>

Production, Planning & Expediting Clerks

SOC CODE: 43-5061

Significant Points

- A high school diploma is required for entry-level positions.
- Numerous job openings will arise each year from the need to replace workers who leave this occupation.
- About half worked for manufacturing establishments.

Nature of the Work

- Production, planning & expediting clerks (referred to going forward as *production clerks*) coordinate and expedite the flow of information, work, and materials, usually according to a production or work schedule.

Production and planning clerks compile records and reports on various aspects of production, such as materials and parts used, products produced, machine and instrument readings, and frequency of defects.

Expediting clerks contact vendors and shippers to ensure that merchandise, supplies, and equipment are forwarded on the specified shipping dates.

- Most of their work is done according to production, work, or shipment schedules that are devised by supervisors who determine work progress and completion dates.
- Production clerks compile reports on the progress of work and on production problems.

Working Conditions

- A typical workweek for production clerks is Monday through Friday. Occasionally, evening and weekend hours may be required.
- Production clerks work closely with supervisors who must approve production and work schedules.

Employment

- Production clerks held about 292,000 jobs in 2004 in the United States and around 13,340 jobs in Pennsylvania.
- Almost 50 percent were employed in the manufacturing sector. Others worked for management consulting firms, warehousing companies and the U.S. Postal Service
- The following table includes the industry groups that employed the most production clerks in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	6,650	49.9%
Services	2,780	20.8%
Wholesale & Retail Trade	1,430	10.7%
Transportation & Warehousing	810	6.1%
Information	800	6.0%

Job Outlook

- Employment of production clerks in Pennsylvania is expected to grow from approximately 13,340 in 2004 to approximately 13,480 in 2014. These clerks can expect about 13 openings due to growth and about 323 replacement openings for approximately 336 total annual openings.
- The work of production clerks is less likely to be automated than that of many other administrative support occupations.
- As increasing pressure is put on firms to manufacture and deliver their goods more quickly and efficiently, the need for production, planning, and expediting clerks will grow.

Earnings

Average hourly earnings of production clerks in Pennsylvania were \$17.52 in 2005. The entry-level rate in 2005 was \$10.07 while an experienced production clerk made \$21.25.

Training, Other Qualifications and Advancement

Production clerk jobs are primarily entry-level positions that require a high school diploma and very little experience. However, some employers prefer to hire those who are familiar with computers and other electronic office equipment. Applicants who have completed a business course may have an advantage.

Newly hired production clerks undergo informal, on-the-job training. Depending on the complexity of the job, training may last anywhere from several days to a few months. Trainees usually learn the job by doing routine tasks under close supervision. They learn how to count and mark stock, and then they start keeping records and taking inventory.

Newly hired production clerks must learn both how their company operates and the company's priorities before they can begin to write production and work schedules efficiently. Good oral and written communication skills are also essential.

Advancement opportunities often vary with the place of employment. Experienced production clerks may be promoted to head clerk. With additional training, some advance to warehouse manager or purchasing agent positions. Others choose to enter a related field such as industrial traffic management.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of production clerks include cargo and freight agents; stock clerks and order fillers; and weighers, measurers, checkers and samplers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Production Planning and Scheduling Association (IPPSA), PO Box 5031, Incline Village NV 89450. Internet: <http://www.ippsa.org>

Shoe & Leather Workers & Repairers

SOC CODE: 51-6041 and 51-6042

Significant Points

- Workers generally learn their craft through on-the-job training.
- Inexpensive imports and improved machinery will cause declines in employment levels.

Nature of the Work

- Shoe & leather workers create stylish, durable leather products. They inspect the leather, cut along the pattern, and sew the pieces together. Other duties may vary with the goods being produced.
 - Orthopedic and therapeutic shoemakers* make or modify footwear according to a prescription.
 - Saddle makers* apply leather dyes and liquid topcoats to produce a glossy finish on saddles. They also decorate the surface with hand stitching or stamping.
 - Luggage makers* fasten leather to a frame and attach hardware, such as handles and wheels.
 - Shoe and leather repairers* extend the lives of worn leather goods. They replace soles, repair heels and re-attach handles.
- Leather workers use hand tools, such as knives, hammers, awls and skivers. They also use power-operated equipment, such as sewing machines and sole stitchers.
- Self-employed workers and shop owners have managerial responsibilities in addition to their regular duties.

Working Conditions

- Work schedules vary with industry. In manufacturing companies, a standard 40-hour week is normal. Evening and weekend work is common in repair shops. Self-employed storeowners often work long hours.
- Shoe & leather workers must be careful when working with machines.
- Work areas can be noisy and odors from leather dyes and stains are often present.

Employment

- Shoe & leather workers held about 15,100 jobs in 2004 in the United States and approximately 1,210 jobs in Pennsylvania.
- Over 72 percent were employed with manufacturing companies, including those that produce apparel, footwear and luggage. About 17 percent were self-employed.
- The following table includes the industries that employed the most shoe & leather workers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Accessories & Other Apparel Mfg	320	26.2%
Footwear Manufacturing	290	24.0%
Leather & Hide Tanning & Finishing	230	18.7%
Self-Employed	210	17.3%
Jewelry, Luggage & Leather Goods Stores	110	9.3%

Job Outlook

- Employment of shoe & leather workers in Pennsylvania is expected to decrease from approximately 1,210 in 2004 to approximately 800 in 2014. About 38 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Improved machinery has increased productivity and reduced the demand for these workers. In addition, inexpensive imports have reduced the costs of leather goods. However, repair work on fine leather products will continue. This will moderate employment decline.
- A growing elderly population and an increased emphasis on foot care will create additional prospects for orthopedic and therapeutic shoemakers. Other shoe & leather workers will not have as many opportunities.

Earnings

- Average hourly earnings of shoe & leather workers & repairers in Pennsylvania were \$10.46 in 2005. The entry-level rate in 2005 was \$7.62 while an experienced shoe & leather worker made \$11.88.
- No Pennsylvania-specific wage information was available for shoe machine operators & tenders. However, the national average hourly earnings of shoe machine operators & tenders were \$10.31 in 2005.

Training, Other Qualifications and Advancement

Most shoe & leather workers learn their craft through on-the-job training. Some participate in organized programs given by the company, while others gather hands-on experience as helpers. A limited number of schools and national shoe repair chains offer programs. These programs, which last less than two years, teach students the basic skills of leather cutting, stitching and dyeing.

Training seminars, industry workshops, and trade shows allow shoe & leather workers to keep their skills up-to-date. Voluntary certification is available for *pedorthists*, individuals who produce or modify prescription footwear. Pedorthists can be certified after completing 120 hours of training and passing an examination.

Manual dexterity and mechanical aptitude are important traits for those in shoe repair and leatherworking occupations. Self-discipline is needed to work with little or no supervision. Individuals who design custom goods should have artistic ability as well. When dealing with customers, workers should have a pleasant manner.

Shoe & leather workers can advance to supervisory positions. Workers who have knowledge of business practices may open their own shop.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of shoe & leather workers include dressmakers, custom sewers, tailors, designers, patternmakers and furriers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Pedorthic Footwear Association, 7150 Columbia Gateway Dr., Suite G, Columbia, MD 21046. Internet: www.pedorthics.org

Structural & Reinforcing Iron & Metal Workers

SOC CODES: 47-2171 and 47-2221

Significant Points

- Job openings are usually more abundant during the spring and summer months.
- Structural and reinforcing metal work is highly sensitive to changes in economic conditions.
- Most employers recommend a formal apprenticeship program for learning this trade.

Nature of the Work

- Structural and reinforcing iron and metal workers fabricate, assemble, and install iron and metal products used in buildings, bridges, highways, lampposts, and other structures. They also repair, renovate, and maintain older buildings and structures.
- The structural metal, reinforcing rods, and ornamental iron arrive at the construction site in ready-to-use sections, which are lifted into position by a mobile crane. Metal workers then connect the sections together.

Structural metal workers connect steel columns, beams, and girders according to blueprints and instructions from supervisors. They temporarily bolt the piece in place and check the alignment. The piece is then bolted or welded in place permanently.

Reinforcing metal workers set the bars into the forms that hold concrete. They follow blueprints that show the location, size, and number of reinforcing bars.

- Ornamental ironwork and related pieces are installed after the exterior of the building has been completed.

Working Conditions

- Structural and reinforcing iron and metal workers usually work outside in all kinds of weather. Those who work at great heights do not work when it is wet, icy, or extremely windy.
- Safety devices, such as safety belts, nets, and scaffolding, are used to reduce the risk of injury due to falls.

Employment

- Structural and reinforcing iron and metal workers held about 106,100 jobs in 2004 in the United States and approximately 3,710 jobs in Pennsylvania.
- Over 53 percent worked for structural steel erection contractors. Twenty percent worked for general residential and nonresidential building contractors. Others were employed with fabricated metal products manufacturers.

Job Outlook

- Employment of structural and reinforcing iron and metal workers in Pennsylvania is expected to grow from approximately 3,710 in 2004 to approximately 4,030 in 2014. These workers can expect about 32 openings due to growth and about 72 replacement openings for approximately 104 total annual openings.
- Employment growth will be spurred by the increased need for rehabilitation and maintenance of older buildings. In addition, more metal workers will be needed to build incinerators and other structures to contain hazardous materials as part of ongoing toxic waste cleanup. Job openings are usually more abundant during the spring and summer months, when the level of construction activity increases.
- Employment in the construction industry is sensitive to changes in the economy. When the level of activity falls, structural and reinforcing metal workers may experience high rates of unemployment.

Earnings

- Average hourly earnings of reinforcing iron and rebar workers in Pennsylvania were \$24.90 in 2005. The entry-level rate in 2005 was \$16.01 while an experienced reinforcing iron and rebar worker made \$29.34.
- Average hourly earnings of structural iron and steel workers in Pennsylvania were \$24.04 in 2005. The entry-level rate in 2005 was \$15.20 while an experienced structural iron and steel worker made \$28.46.

Training, Other Qualifications and Advancement

Most employers recommend apprenticeship programs as the best way to learn this trade. However, some structural and reinforcing iron and metal workers learn the trade informally through on-the-job training. On-the-job training usually takes longer than an apprenticeship program.

Apprenticeship programs, which are often sponsored by joint training committees, typically last three to four years. These programs combine on-the-job training with classroom instruction in blueprint reading, mathematics, structural erecting, rigging, reinforcing, welding, and burning as well as ornamental erection and assembling. Apprentices also study the care and safe use of tools and materials.

On-the-job trainees assist experienced workers by carrying materials. With experience, they perform more difficult tasks like cutting and fitting different parts. Although some large contractors offer extensive training programs, most companies do not offer any formal classroom training.

When hiring helpers and apprentices, employers prefer high school graduates who are at least 18 years old and in good physical condition. They also need good agility, balance, eyesight, and depth perception to safely work at great heights on narrow beams and girders. Structural and reinforcing iron and metal workers should not be afraid of heights or suffer from dizziness. Those with previous course work in mechanical drawing, shop, and general mathematics may have an advantage.

Some experienced structural and reinforcing iron and metal workers advance into supervisor positions. Others become self-employed contractors.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of structural and reinforcing iron and metal workers include cement masons and concrete finishers, operating engineers, and welders.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Associated General Contractors of America, 333 John Carlyle St., Alexandria, VA 22314.
Internet: <http://www.agc.org>

Textile Machinery Operators

SOC CODES: 51-6061, 51-6062, 51-6063, 51-6064 and 51-6091

Significant Points

- Open trading, laborsaving machinery and increased productivity will contribute to employment declines.
- Individuals with strong technical skills will have the best opportunities.
- Employers prefer applicants with technical training beyond high school.

Nature of the Work

- *Textile machinery operators* tend machines that manufacture a wide range of textile products. Operator duties vary with the product and type of machinery being used. Most textile machinery operators are responsible for preparing and maintaining their equipment.
- The textile production process begins with the preparation of synthetic or natural fibers, which are then spun into yarn. Different fibers may be combined to give products a desired texture or durability.
- Heat and chemicals are used to weave, knit, tuft, or bond finished yarn. The resulting fabric is then dyed and finished. Products are often treated to prevent excessive shrinkage, provide additional strength, make them stain-resistant, or give them a silky luster.
- Most of the machinery used in textile mills is computer-controlled. This allows one person to operate and monitor several machines.

Working Conditions

- Textile machinery operators work a 40-hour week. Because most mills operate 24 hours a day, night and weekend shifts are common.
- Newer facilities offer better ventilation and climate control systems, which reduce potential problems caused by airborne fibers and fumes. To reduce health risks, workers in older facilities must wear protective glasses and masks. Machine operators in all facilities wear ear protection.
- Extruding and forming machine operators wear protective shoes and clothing when working with certain chemical compounds.

Employment

- Textile machinery operators held about 170,300 jobs in 2004 in the United States and approximately 6,360 jobs in Pennsylvania.
- Nearly 82 percent worked for manufacturing companies, including fabric and fiber mills. About 7 percent worked for management consulting firms.
- The following table includes the industries that employed the most textile machinery operators in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Fabric Mills	1,940	30.6%
Fiber, Yarn & Thread Mills	530	8.3%
Management of Companies & Enterprises	470	7.4%
Employment Services	470	7.3%
Textile Furnishings Mills	460	7.2%

Job Outlook

- Employment of textile machinery operators in Pennsylvania is expected to decrease from approximately 6,360 in 2004 to approximately 3,940 in 2014. About 117 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- An open trading environment, laborsaving machinery and increased worker productivity are all important factors in the decline of employment levels.
- Individuals with strong technical skills and computer training will have the best opportunities.

- Unlike most textile machine operating occupations, extruding machine operators should experience employment growth in the coming years.

Earnings

- In Pennsylvania, textile machinery operators averaged \$9.60 to \$14.60 per hour in 2005. Entry-level rates were between \$7.10 and \$10.70 per hour, while experienced textile machinery operators earned anywhere from \$10.90 to \$16.60 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different textile machinery operators in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Textile Bleaching & Dyeing Machine Operators/Tenders	\$12.33	\$10.12	\$13.43
Textile Cutting Machine Setters/Oprs/Tenders	\$9.64	\$7.10	\$10.91
Textile Knitting & Weaving Machine Setters/Oprs/Tenders	\$12.25	\$8.95	\$13.90
Textile Winding, Twisting & Drawing Out Machine Setters/Oprs/Tenders	\$10.94	\$8.18	\$12.33
Extruding & Forming Machine Setters/Oprs/Tenders	\$14.56	\$10.62	\$16.53

Training, Other Qualifications and Advancement

A high school diploma, or equivalent, is the common requirement for most entry-level positions. However, some employers prefer to hire individuals with additional technical training beyond high school. Formal programs are available through technical schools. A few companies and machinery manufacturers offer extensive on-the-job training programs.

Physical stamina and manual dexterity are important traits for all textile machinery operators. Those with self-direction, initiative, and strong interpersonal skills will flourish under the new organizational structure, which promotes teamwork and streamlines management. As automation increases, machine operators will need a basic knowledge of electronics and computers in order to diagnose machine problems.

Most textile machinery operators advance to positions that require additional skills and increased responsibility. Some are promoted to supervisory positions. Others become instructors and train new employees.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of textile machinery operators include metalworking and plastics-working machine operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Textile Manufacturers Institute, Inc., 1130 Connecticut Ave. NW, Suite 1200, Washington, DC 20036-3954. Internet: <http://www.atmi.org>
- Institute of Textile Technology, 2401 Research Dr., Box 8301, Raleigh, NC 27695-8301. Internet: <http://www.itt.edu>

Tool & Die Makers

SOC CODE: 51-4111

Significant Points

- Most skills are acquired through postsecondary and on-the-job training.
- Increased automation will contribute to limited employment growth.

Nature of the Work

- Tool & die makers produce and repair tools, dies, and guiding devices that enable machines to manufacture a variety of products.

Toolmakers craft and repair precision tools, which are used to cut, shape, and form metal and other materials. They may also produce jigs, fixtures, gauges, and other measuring devices.

Die makers construct and repair metal forms that are used to shape metal in stamping and forging operations. They also make metal molds for plastics, ceramics, and composite materials.

- Because they use many types of machine tools and precision measuring instruments, tool & die makers usually have a broader knowledge of machining operations and blueprint reading than other machine operators.
- Computer-aided design (CAD) is often used to develop products and parts. Electronic drawings are then created and processed by a computer-aided manufacturing (CAM) program, which calculates cutting paths and establishes the sequence of operations. Once the sequence is developed, computer numerically controlled (CNC) machines produce the die.

Working Conditions

- Companies that employ tool & die makers have traditionally operated with one shift per day. As costs and technologies increase, multiple shifts have become commonplace. In addition, overtime and weekend work may be required during peak production periods.
- Tool rooms are cool and clean. They are usually much quieter than the production floor.
- Because they spend most of their day standing and lifting equipment, tool & die makers need a lot of stamina.
- Strict safety procedures must be followed. Workers are usually required to wear protective equipment, such as safety glasses, earplugs, gloves and masks.

Employment

- Tool & die makers held about 102,600 jobs in 2004 in the United States and around 5,320 jobs in Pennsylvania.
- Over 96 percent worked in the manufacturing sector – about one-third for companies that manufacture metalworking machinery and equipment.
- The following table includes the industries that employed the most tool and die makers in 2004 in Pennsylvania.

Industry	2002 Employment	Percent
Metalworking Machinery Manufacturing	1,730	32.5%
Machine Shops & Threaded Products	330	6.2%
Plastics Product Manufacturing	320	6.1%

Job Outlook

- Employment of tool & die makers in Pennsylvania is expected to decrease from approximately 5,320 in 2004 to approximately 5,030 in 2014. About 120 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Automation has increased worker productivity, which contributes to the limited employment growth of tool & die makers. However, companies will still rely heavily on skilled tool & die makers for retooling. This fact, coupled with a growing demand for machined metal parts, should help to moderate the decline in employment.
- Employers reported difficulties finding qualified workers to fill positions. Applicants with the appropriate skills and background should enjoy excellent opportunities.

Earnings

Average annual earnings of tool & die makers in Pennsylvania were \$39,490 in 2005. The entry-level wage in 2005 was \$28,400 while an experienced tool & die maker made \$45,040.

Training, Other Qualifications and Advancement

Tool & die makers obtain training through formal apprenticeship, postsecondary, and on-the-job programs. Although employers agree that formal apprenticeships offer the best all-around training, these programs are very rare. As a result, most tool & die makers learn their skills through postsecondary and on-the-job training.

Trainees learn how to operate machine tools, hand tools, assembling gauges, and other metal-forming equipment. They often begin as machine operators and gradually take on more difficult assignments. Necessary classroom instruction is usually obtained at a community or technical college.

Aspiring tool & die makers should be mechanically inclined and able to work independently. Because product specifications are strict, workers must be patient and detail-oriented. Accurate eyesight is also essential. Computer skills are increasingly important as CAD technology and CNC machines become more popular.

Skilled tool & die makers can become tool designers or machine tool programmers. Some advance to supervisory and administrative positions. Others go back to school, obtain a college degree, and transfer into an engineering position. Experienced tool & die makers may open their own shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of tool & die makers include machinists; computer-controlled programmers and operators; metal and plastics machine operators; and welding, soldering and brazing workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Precision Metalforming Association, 6363 Oak Tree Blvd., Independence, OH 44131-2500.
Internet: <http://www.metalforming.com>
- Tooling and Manufacturing Association, 1177 S. Dee Rd., Park Ridge, IL 60068.
Internet: <http://www.tmanet.com>
- Precision Machined Products Association, 6700 W. Snowville Rd., Brecksville, OH 44141.
Internet: <http://www.pmpa.org>
- National Tooling and Metalworking Association, 9300 Livingston Rd., Ft. Washington, MD 20744.
Internet: <http://www.ntma.org>
- PMA Educational Foundation, 6363 Oak Tree Blvd., Independence, OH 44131-2500.
Internet: <http://www.pmaef.org>

Welding, Soldering & Brazing Workers

SOC CODES: 51-4121 and 51-4122

Significant Points

- Training program length varies with the skill level of the job.
- Opportunities should be good for skilled workers.
- Automation and increased worker productivity may impact employment growth.

Nature of the Work

- Welding is the most common way of permanently joining two or more metal parts. There are several different types of welders, including manual, semi-automatic and automatic.

Manual welders control the entire welding process themselves.

Semi-automatic welders use machinery to help perform welding tasks.

Automated welders monitor a welding machine, which is responsible for performing all welding tasks.

- Skilled welders generally plan work from drawings or specifications and use their knowledge to analyze damaged metal parts. Routine jobs are left for less skilled workers.
- The work of arc, plasma and flame cutters is closely related to that of welders. Instead of joining metals, *cutters* use heat or an electric arc to cut and trim metal objects. They also dismantle large objects, such as ships and aircraft. Some operate and monitor cutting machines.

Working Conditions

- Most welding, soldering & brazing workers work a standard 40-hour week. However, overtime is common and some individuals work up to 70 hours per week. Shifts may last as long as 12 hours.
- Work may be performed indoors or outdoors through extreme weather conditions and in confining spaces. Some work is done on scaffolds or platforms, located high off the ground.
- Protective equipment, such as safety shoes, goggles, and welding hoods, must be worn at all times. The risk of injury is not as great for automated welding machine operators.

Employment

- Welding, soldering & brazing workers held about 428,900 jobs in 2004 in the United States and approximately 19,010 jobs in Pennsylvania.
- Approximately three-quarters were employed with manufacturing companies, including those that produce architectural metal products, vehicles and construction machinery.
- The following table includes the industries that employed the most welding, soldering & brazing workers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Architectural & Structural Metals Mfg	2,980	15.7%
Motor Vehicle Body & Trailer Mfg	1,690	8.9%
Ag., Construction & Mining Machinery Mfg	1,300	6.8%
Commercial Machinery Repair/Maintenance	880	4.6%

Job Outlook

- Employment of welding, soldering & brazing workers in Pennsylvania is expected to grow from approximately 19,010 in 2004 to approximately 19,020 in 2014. About 545 annual openings will result from replacement needs. Although minimal employment growth is expected statewide, growth openings may exist in some areas.
- Automation and increased worker productivity will dampen employment growth for welders and cutters. However, the demand for welding machine operators should increase as automation use grows.
- Employment levels may be affected by economic cycles. Because welders are used in almost every manufacturing industry, a strong economy will keep employment demand high. On the other hand, an economic downturn would have a negative effect and could cause layoffs.

- Job opportunities for skilled individuals should be excellent as employers continue to report difficulties in finding qualified workers.

Earnings

- Average annual earnings of welders, cutters, solderers & brazers in Pennsylvania were \$33,160 in 2005. The entry-level rate in 2005 was \$23,830 while an experienced welder made \$37,820.
- Average annual earnings of welding, soldering & brazing machine workers in Pennsylvania were \$31,320 in 2005. The entry-level rate in 2005 was \$21,590 while an experienced welding machine worker made \$36,190.

Training, Other Qualifications and Advancement

Training programs can vary in length depending on the job. Lower skilled positions usually require a few weeks of on-the-job training, while higher skilled jobs may require several years of on-the-job training combined with classroom instruction. Formal training is available through some employers, high schools, vocational schools, vocational-technical institutes, community colleges, private welding schools, and the Armed Forces.

Employers can choose to send welding workers for certification. Chosen workers report to a testing institution, where they are expected to weld a test specimen. This specimen must adhere to specific codes and standards as established by industry associations. If the welding inspector determines that it does, the welder is then granted certification for that particular procedure.

Aspiring welding, soldering & brazing workers should have good eyesight, hand-eye coordination, and manual dexterity. The ability to concentrate on detailed work for long periods of time is essential. Previous courses in blueprint reading, shop mathematics, mechanical drawing, physics, chemistry, and metallurgy provide a strong background. Computer skills are also very important. Workers must be willing to receive additional training and perform tasks in other production jobs.

With additional training and experience, workers can advance to higher skilled jobs. Welding, soldering & brazing workers may become welding technicians, supervisors, inspectors or instructors. Some open their own repair shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of welding, soldering & brazing workers include machinists; blacksmiths; forge shop workers; machine-tool operators; tool & die makers; millwrights; sheet metal workers; boilermakers; computer-controlled programmers & operators; and metal & plastics machine operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Welding Society, 550 NW LeJeune Rd., Miami, FL 33126. Internet: <http://www.aws.org>

Woodworkers

SOC CODES: 51-7011, 51-7021, 51-7031, 51-7032, 51-7041 and 51-7042

Significant Points

- Opportunities will be best for those with a working knowledge of computer-controlled machines.
- Skills are learned through on-the-job training programs.
- More than 82 percent worked in the manufacturing sector.

Nature of the Work

- **Production woodworkers** set up, operate, and tend woodworking machines that cut and shape components from lumber, plywood, and other wood products. Once the pieces have been assembled, the final product can be sanded, stained, and sealed.
- **Precision woodworkers** build one-of-a-kind items. They perform all of the tasks that are involved with turning wood components into a finished product.
- The introduction of computer-controlled machinery has increased worker productivity and simplified set-up procedures for production woodworkers. Because precision woodworkers do a lot of intricate woodworking, they have not been as greatly impacted.

Working Conditions

- Prolonged standing and heavy lifting are common characteristics of the job.
- Woodworkers may encounter excessive noise, as well as dust and other air pollutants.
- Adherence to safety precautions and increased automation help minimize any risk of injury.

Employment

- Woodworkers held about 337,400 jobs in 2004 in the United States and around 14,340 jobs in Pennsylvania.
- About 39 percent worked for manufacturing companies that produce household and institutional furniture. Others worked for wood product manufacturers and sawmills. About 1 in 14 were self-employed.
- The following table includes the industries that employed the most woodworkers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Household & Institutional Furniture	5,500	38.3%
Other Wood Product Manufacturing	3,160	22.0%
Sawmills & Wood Preservation	1,090	7.6%
Self-Employed	1,010	7.1%
Office Furniture & Fixtures Mfg	640	4.4%

Job Outlook

- Employment of woodworkers in Pennsylvania is expected to decrease from approximately 14,340 in 2004 to approximately 13,650 in 2014. About 377 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Increases in population, personal income, and business expenditures will stimulate the demand for wood products. Likewise, repair and renovation work is always in demand.
- Employment levels will be impacted by technological advances, increased use of imported goods, and environmental measures designed to control pollutants. Opportunities will be best for highly skilled workers, who have a working knowledge of computer-controlled machines.
- Woodworking occupations are highly sensitive to economic cycles. When the level of activity falls, workers may experience reduced work hours and even layoffs.

Earnings

- Overall, wood model makers earned the highest wages at all levels of experience. Sawing machine setters, operators & tenders had the lowest wages across all levels of experience.

- In Pennsylvania, woodworkers averaged \$12.00 to \$17.40 hourly in 2005. Entry-level wages were between \$8.88 and \$11.30 while experienced woodworkers earned anywhere from \$13.50 to \$20.40.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for different woodworking occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Cabinetmakers & Bench Carpenters	\$14.16	\$9.41	\$16.54
Furniture Finishers	\$12.78	\$9.23	\$14.55
Model Makers, Wood	\$17.32	\$11.25	\$20.35
Patternmakers, Wood	\$16.70	\$10.62	\$19.75
Sawing Machine Setters/Operators/Tenders	\$12.00	\$8.88	\$13.55
Woodworking Machine Setters/Operators/Tenders	\$12.39	\$8.91	\$14.13

Training, Other Qualifications and Advancement

Most woodworkers learn their trade through on-the-job training programs. Some attend vocational schools, colleges, or universities. Others gain practical experience as carpenters before transferring into other woodworking occupations.

Trainees usually observe and help out experienced woodworkers. Duties may include supplying materials and removing the final products from the machine. As they gain experience, woodworking trainees move onto more complex jobs and receive less supervision. Basic training lasts a few months but at least two years of training are required to become a skilled woodworker.

Employers seek applicants who have a high school diploma or equivalent. Previous courses in science, mathematics, and computers can enhance employment prospects. Successful woodworkers should have mechanical aptitude, manual dexterity, and the ability to pay attention to detail. Because machinery is becoming more sophisticated, there is a constant need for continuing education.

Advancement opportunities are limited and often depend on seniority. Additional training, which may be obtained through workshops and college programs, may be required to advance to supervisor or inspector positions. Highly skilled woodworkers may open their own shop.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of woodworkers include precision metalworkers, metalworking and plastics-working machine operators, metal fabricators, sheet metal workers, machinists, tool and die workers, molders, and leather workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Furniture Manufacturers Association, Manufacturing Services Division, PO Box HP-7, High Point, NC 27261. Internet: <http://www.afma4u.org>

Technical and Repair Services

Technical and Repair Services Occupations

This portion of the Handbook examines careers in the technical and repair services career cluster. This cluster contains careers in automotive, telecommunications, electronics, industrial machinery and many more.

Vehicle and mobile equipment repairers offer the most annual job openings in this cluster, particularly automotive mechanics and body repairers. Due to the rapid increase in sophistication of automotive technology, job opportunities are expected to be best for persons who complete automotive training programs in high schools, vocational and technical schools, or community colleges.

Diesel engine mechanics offer significant employment opportunities, expecting to offer over 530 openings each year statewide. The increasing volume of freight shipped by trucks will help spur this demand.

Expansion of telecommunication networks has created a demand for telephone and cable line installers and repairers. This occupation has experienced a substantial amount of employment growth in recent years and should continue to do so. Training requirements for these occupations are a minimum of a high school diploma and in most cases some technical knowledge of electricity or electronics.

Industrial and general maintenance mechanics and repairers should have favorable job prospects even though growth is expected to be slower than average in these occupations. Job openings will arise through the need to replace mechanics and repairers who retire or move to other occupations. Unlike many other occupations concentrated in manufacturing industries, workers in maintenance and repair occupations are less likely to be affected during adverse economic periods.

A detailed analysis of the above-mentioned occupations, and many others, is contained in the pages following this introduction.

Technical and Repair Services Occupations

The occupations in green are either new to this edition or have had a name change since the last.

Aircraft & Avionics Equipment Mechanics & Service Technicians

Handlers, Equipment Cleaners, Helpers & Laborers

Automotive Body & Glass Repairers

General Maintenance & Repair Workers

Automotive Service Technicians & Mechanics

Home Appliance Repairers

Blue-Collar Worker Supervisors

Industrial Machinery Repairers

Coin, Vending & Amusement Machine Servicers & Repairers

Line Installers & Repairers

Computer, Automated Teller & Office Machine Repairers

Millwrights

Diesel Engine Technicians & Mechanics

Mobile Heavy Equipment Mechanics

Electrical & Electronics Installer & Repairers

Precision Assemblers

Electronic Home Entertainment Repairers

**Radio & Telecommunications Equipment
Installers & Repairers**

Farm Equipment Mechanics

Small Engine Mechanics

Auxiliary aids and services are available upon request to individuals with disabilities.
Equal Opportunity Employer/Program

Contact the Center for Workforce Information & Analysis for alternate formats at workforceinfo@state.pa.us, (717) 787-6466 or
toll-free at 1-877-493-3282.

Aircraft & Avionics Equipment Mechanics & Service Technicians

SOC CODES: 49-2091 and 49-3011

Significant Points

- Keen competition is expected for jobs with major airlines.
- Job prospects will be best for applicants with significant experience.
- Most skills are acquired through certified trade schools.

Nature of the Work

- Aircraft & avionics equipment mechanics & service technicians are responsible for making repairs, performing maintenance, and completing inspections that are required by the Federal Aviation Administration (FAA).
- Some mechanics work on a particular type of aircraft while others concentrate on a specific section.
 - **Powerplant mechanics** work on aircraft engines. They may do limited work on propellers.
 - **Airframe mechanics** are allowed to work on any part of the aircraft except the instruments, powerplants, and propellers.
 - **Combination airframe-and-powerplant mechanics**, also called A & P mechanics, are authorized to work on all parts of the aircraft, except instruments. Civilian aircraft mechanics are usually A & P mechanics.
 - **Avionics technicians** repair and maintain components used for navigation, radio communications, weather radar systems, and flight control computers. These duties may require additional licenses.
- Large, sophisticated planes are equipped with aircraft monitoring systems that provide valuable diagnostic information to the mechanic. To get the aircraft back in service, mechanics must work as fast as safety permits.
- Aircraft must be inspected on a regular basis. The schedule may be based on the number of hours flown, cycles of operation, calendar days, or any combination of these factors. Worn or defective parts are repaired or replaced. After all repairs have been completed, mechanics test the aircraft to ensure that it works properly.

Working Conditions

- Most aircraft mechanics work 40 hours per week on eight-hour shifts. Because flights occur 24-hours a day, mechanics must be on duty around the clock. Overtime work is common.
- Work is usually performed in hangars or other indoor areas. Outdoor work may be necessary when the hangars are full or when repairs must be made quickly.
- Mechanics often stand, lie, or kneel in awkward positions. Occasionally, they work on scaffolds or ladders. In addition, workers should be able to lift or pull objects that weigh up to 70 pounds.
- Pressure to uphold safety standards and maintain flight schedules can cause stress for aircraft mechanics.

Employment

- Aircraft & avionics mechanics held about 142,100 jobs in 2004 in the United States and approximately 3,630 jobs in Pennsylvania.
- About 53 percent were employed with Federal government agencies. Thirty-five percent worked for airlines, airports and flying fields.
- The following table includes the industries that employed the most aircraft & avionics mechanics in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Federal Government	1,930	53.1%
Scheduled Air Transportation	660	18.3%
Support Activities for Air Transport	500	13.8%

Job Outlook

- Employment of aircraft & avionics mechanics in Pennsylvania is expected to decrease from approximately 3,630 in 2004 to approximately 3,540 in 2014. About 95 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.

- An expanding population and rising incomes will stimulate the demand for airline transportation. However, employment growth will be somewhat restricted by increases in worker productivity.
- Because high wages and travel benefits attract more qualified applicants than there are openings, aircraft mechanics will face competition for jobs with large airlines. Opportunities will be best at small commuter airlines, regional airports, and FAA repair stations.
- Job prospects should be best for applicants with significant experience. Demand will be greatest for mechanics who keep abreast of technological advances in electronics and composite materials.

Earnings

- Average hourly earnings of avionics technicians in Pennsylvania were \$20.26 in 2005. The entry-level rate in 2005 was \$17.84 while an experienced avionics technician made \$21.48.
- Average hourly earnings of aircraft mechanics & service technicians in Pennsylvania were \$22.52 in 2005. The entry-level rate in 2005 was \$16.86 while an experienced aircraft mechanic made \$25.35.
- In addition, most airline mechanics and their immediate families receive reduced airfare.

Training, Other Qualifications and Advancement

Although a few aircraft mechanics learn their skills through on-the-job training, most attend FAA-certified trade schools. These programs, which normally last 24 to 30 months, provide students with hands-on training in the operation of tools and equipment they will use on the job. Program graduates, especially those with military experience, are the most desirable applicants to employers. However, skills learned in the Armed Forces are very specialized and do not provide the broad experience required by the FAA. Therefore, even military mechanics must complete the entire trade school training program.

Mechanics who have at least 18 months of work experience may apply for airframe, powerplant, or avionics repairer certificates. However, most airlines require a high school diploma and an A & P certificate. To obtain this A & P certificate, at least 30 months of experience with engines and airframes is needed. However, completion of an FAA-certified training program may be substituted for the experience requirement. Certificate applicants must pass written and oral examinations. In addition, they must demonstrate their practical skills.

FAA regulations require current experience to keep the A & P certification valid. Applicants must have compiled 1,000 hours of experience over the past 24 months or they must take a refresher course. In addition, aircraft mechanics are required to take at least 16 hours of training every two years. Many manufacturers and employers offer ongoing training. Aircraft mechanics who have held an A & P certificate for at least three years may obtain an inspector's authorization. Those designated with an inspector's authorization can then certify work completed by other mechanics and perform required inspections.

Aircraft mechanics perform skilled work that requires a high degree of mechanical aptitude. Employers seek hard-working, self-motivated individuals who are able to diagnose complex mechanical problems. In addition, aircraft mechanics should be agile and unafraid of heights. Previous courses in mathematics, physics, chemistry, electronics, computer science, mechanical drawing, and writing are very helpful. As new aircraft are designed, applicants must be willing to update their skills.

Experienced aircraft mechanics may advance to inspector, lead mechanic, lead inspector, or shop supervisor positions. Some mechanics take positions as FAA inspectors. Others transfer to skilled repairer occupations or electronic technician jobs. A few open their own aircraft maintenance facilities. Overall, advancement opportunities are best for authorized inspectors.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of aircraft & avionics mechanics include electricians, electrical & electronics installers & repairers, and elevator installers & repairers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Professional Aviation Maintenance Association. 717 Princess Street, Alexandria, VA 22314
Internet: <http://www.pama.org>

Automotive Body & Glass Repairers

SOC CODE: 49-3021 and 49-3022

Significant Points

- Job opportunities should be best for those with formal training.
- Many employers offer on-the-job training programs.
- More than half worked in automotive repair shops.

Nature of the Work

- *Automotive body & glass repairers* straighten vehicle bodies, remove dents, and replace damaged parts. Most work on cars and small trucks, although some work is performed on larger vehicles.
- Special equipment is used to restore damaged metal frames and body sections. Badly damaged sections are removed with a pneumatic metal-cutting gun and a replacement section is welded in place. For less serious dents, repairers use hydraulic jacks, hand prying bars, pneumatic hammers, or hand tools.
- These workers also repair the plastic body parts that are used on newer vehicles. With most plastics, automotive body repairers can apply heat and press the softened body panel back into shape by hand.

Working Conditions

- Automotive body & glass repairers usually work a typical 40-hour week, although some put in 60 or more hours a week.
- Generally, automotive body & glass repairers work alone, receiving only broad directions from supervisors.
- Most work is done inside noisy body shops, which are well ventilated to disperse dust and paint fumes.
- Body repair work can be strenuous and dirty. Workers may be forced into awkward or cramped positions. Potential hazards include cuts, burns, injuries, and exposure to paint fumes.

Employment

- Automotive body & glass repairers held about 222,900 jobs in 2004 in the United States and approximately 11,060 jobs in Pennsylvania.
- Fifty-seven percent were employed with automotive repair shops. Another 24 percent worked for automobile dealerships. About 1 in 8 were self-employed.
- The following table includes the industries that employed the most automotive body & glass repairers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Automotive Repair & Maintenance	6,300	57.0%
Automobile Dealers	2,630	23.7%
Self-Employed	1,380	12.5%

Job Outlook

- Employment of automotive body & glass repairers in Pennsylvania is expected to grow from approximately 11,060 in 2004 to approximately 11,090 in 2014. Automotive body & glass repairers can expect about 3 openings due to growth and about 223 replacement openings for approximately 226 total annual openings.
- As the number of motor vehicles in operation continues to grow, so will the demand for qualified automotive body repairers. New automobile designs have body parts made of steel alloys, aluminum and plastic. These materials are more difficult to work with than traditional steel body parts. In addition, newer vehicle designs are lightweight and more prone to damage than older designs.
- Job opportunities should be best for those with formal training in automotive body repair & mechanics.

Earnings

- Average hourly earnings of automotive body repairers in Pennsylvania were \$15.71 in 2005. The entry-level rate in 2005 was \$10.98 while an experienced automotive body repairer made \$18.08.

- Average hourly earnings of automotive glass installer & repairers in Pennsylvania were \$12.97 in 2005. The entry-level rate in 2005 was \$9.79 while an experienced automotive glass installer made \$14.56.
- Many auto body repairers are paid on an incentive basis. Total earnings depend on the amount of work assigned and how fast it is completed.

Training, Other Qualifications and Advancement

Most employers prefer to hire applicants who have completed a formal training program in automotive body repair. Formal training is highly desirable because graduates are exposed to the newest repair techniques. Many high schools, vocational schools, trade schools, and community colleges offer these programs.

On-the-job training programs are available for aspiring automotive body repairers who have no formal training. When hiring entry-level helpers, employers look for high school graduates who know how to operate hand tools. Basic mathematics, reading, and computer skills are also essential. Selected helpers assist experienced repairers with simple tasks. After mastering the simple jobs, helpers progress to more difficult tasks. In general, it requires three to four years of on-the-job training to become skilled in all aspects of body repair.

Voluntary certification is available through the National Institute for Automotive Service Excellence (ASE). A semi-annual series of four examinations is offered for collision repair professionals. To earn ASE certification, applicants must pass at least one of these examinations and have two years of hands-on experience. Completion of a postsecondary program may be substituted for one year of work experience. Applicants who pass all four exams are awarded the designation of ASE Master Collision Repair & Refinish Technician. To retain certification, workers must retake the examination every five years.

Automotive parts, body materials, and electronics continue to change. They become more complex and technologically advanced. To keep up with these advancements, automotive body repairers must take classes, attend seminars, and read technical manuals.

Experienced workers who have supervisory skills may advance to shop supervisor. Other automotive body repairers take positions as damage appraisers for insurance companies. Some open their own body shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of automotive body & glass repairers include automotive service technicians and mechanics, diesel service technicians and mechanics, auto damage insurance appraisers, and painter and coating workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Automotive Service Association, PO Box 929, Bedford, TX 76095-0929. Internet: <http://www.asashop.org>
- Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201. Internet: <http://www.accsct.org>
- National Automobile Dealers Association, 8400 Westpark Dr., McLean, VA 22102. Internet: <http://www.nada.org>
- National Automotive Technician Education Foundation, 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Internet: <http://www.natef.org>
- National Institute for Automotive Service Excellence, 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Internet: <http://www.asecert.org>
- Inter-Industry Conference On Auto Collision Repair Education Foundation (I-CAR), 3701 Algonquin Rd., Suite 400, Rolling Meadow, IL 60008. Telephone (toll free): 800-422-7872.

Automotive Service Technicians & Mechanics

SOC CODE: 49-3023

Significant Points

- Job prospects will be best for graduates of formal automotive training programs.
- Voluntary certification is available.
- About 1 in 9 were self-employed.

Nature of the Work

- Automotive service technicians & mechanics inspect, maintain, and repair vehicles that have gasoline engines. Within larger shops, mechanics may specialize in one area or service.
 - Automatic transmission technicians* perform work on automatic transmissions.
 - Automotive-radiator mechanics* clean radiators, locate leaks, and install replacement radiators.
 - Automotive air-conditioning repairers* install and repair air conditioners and components. Specialized training is required to learn about the regulations that govern the handling and disposal of refrigerants.
 - Brake repairers* adjust and repair brake systems.
 - Front-end mechanics* align and balance wheels. They also repair steering and suspension systems.
 - Tune-up technicians* ensure efficient engine performance.
- After getting a description of the problem, service technicians rule out the components or systems that are not the cause. Technicians may have to test drive the vehicle or use a variety of testing equipment to identify the problem. Appropriate adjustments and repairs are then made to correct the problem.
- During routine service checks, automotive mechanics usually follow a checklist to ensure that all of the important parts are inspected.
- Hand tools, power tools, welding equipment, and other precision equipment are used to repair broken parts. Electronic equipment and computerized diagnostic devices are also used to locate malfunctions.

Working Conditions

- Most automotive service technicians & mechanics work a 40-hour week. Self-employed workers may have longer hours. To satisfy customer needs, many service shops offer evening and weekend service.
- Work is usually performed in well-lit repair shops that are also well ventilated. However, some service shops can be drafty and noisy.
- Service technicians may have to handle greasy automotive parts. To repair equipment, they may have to lift heavy items or work in awkward positions.
- Although minor cuts and bruises are common, serious accidents can be avoided if safety practices are observed.

Employment

- Automotive service technicians & mechanics held about 802,800 jobs in 2004 in the United States and approximately 38,290 jobs in Pennsylvania.
- Over 60 percent worked for retail car dealerships or automotive repair shops. About 1 in 9 were self-employed.
- The following table includes the industries that employed the most automotive service technicians & mechanics in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Automobile Dealers	12,170	31.8%
Automotive Repair & Maintenance	11,370	29.7%
Self-Employed	4,180	10.9%
Gasoline Stations	2,480	6.5%
Auto Parts, Accessories, & Tire Stores	2,120	5.5%

Job Outlook

- Employment of automotive service technicians & mechanics in Pennsylvania is expected to grow from approximately 38,290 in 2004 to approximately 40,630 in 2014. Automotive mechanics can expect about 234 openings due to growth and about 1,019 replacement openings for approximately 1,252 total annual openings.
- Employment growth will be stimulated by increases in the driving population and number of households with multiple vehicles. Growth will be concentrated in automobile dealerships, specialty car care chains, and independent repair shops. The employment level of service technicians in gas stations will decline.
- Job prospects should be best for graduates of formal training programs. Those who acquire basic electronics skills will have the best opportunities.
- Economic conditions have little effect on the automotive repair business. However, employers may be more reluctant to hire inexperienced workers during an economic downturn.

Earnings

- Average hourly earnings of automotive service technicians & mechanics in Pennsylvania were \$15.61 in 2005. The entry-level rate in 2005 was \$9.78 while an experienced automotive mechanic made \$18.53.
- Many service technicians receive a commission in addition to their weekly salary. Because of this, actual earnings depend on the amount of work that is completed.

Training, Other Qualifications, and Advancement

Employers prefer to hire automotive service technicians & mechanics who have completed a formal training program beyond high school. However, some still learn their skills through on-the-job training. Although apprenticeships were once very popular, very few are offered any more.

Many high schools, community colleges, and vocational-technical schools offer automotive service technician training programs. Some high school programs offer a basic introduction to automotive technology while others provide graduates with enough skills to become an entry-level mechanic. Postsecondary programs combine classroom instruction with hands-on experience. Trade and technical schools offer concentrated programs that last about six to 12 months. Community college programs are usually spread out over two years and are supplemented with classes in English, basic mathematics, and computers. Graduates of these programs may be awarded an associate's degree or certificate.

On-the-job trainees help experienced mechanics complete basic tasks. After a few months, trainee mechanics are assigned routine tasks and simple repairs. About two to five years of on-the-job experience is required to become a journey-level technician. Different specialties may require longer periods of training than others. For example, a great deal of training is required to perform transmission repair. On the other hand, most radiator mechanics and brake specialists learn their job skills in less time. Graduates of the best postsecondary programs may be promoted to the journey level after only a few months.

Voluntary certification is available through the National Institute for Automotive Service Excellence (ASE). Automotive mechanics may be certified in any or all of eight repair areas. To earn ASE certification, applicants must pass at least one examination and have two years of hands-on experience. Completion of a formal training program may be substituted for up to one year of work experience. Applicants who pass all eight examinations are awarded the designation of master automotive mechanic. To retain certification, workers must retake the examination every five years.

When hiring automotive mechanics, employers look for applicants with strong communication and analytical skills. Basic reading, mathematics, and computer skills are also required. In addition, knowledge of electronics is very important. Aspiring service technicians need mechanical aptitude and knowledge of how automobiles work. Previous experience working on vehicles in the Armed Forces or as a hobby is valuable. To keep abreast of new technologies, automotive technicians must be willing to learn new services and procedures.

Personal tools are very important to service technicians. Although employers usually furnish power tools and computerized testing equipment, automotive service technicians and mechanics are expected to accumulate their own hand tools. Experienced workers have invested thousands of dollars in their tools.

Experienced service technicians can advance to shop supervisor or service manager positions. Those who work well with customers may become repair service estimators. A few open their own repair shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of automotive service technicians & mechanics include diesel service technicians and mechanics, automotive body repairers, and small-engine mechanics.

Sources of Additional Information

- Team Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201 Internet: <http://www.accsct.org>
- Automotive Service Association, PO Box 929, Bedford, TX 76095-0929. Internet: <http://www.asashop.org>
- Automotive Retailing Today, 8400 Westpark Dr., MS #2, McLean, VA 22102.
Internet: <http://www.autoretailing.org>
- Automotive Youth Educational Systems (AYES), 50 W. Big Beaver, Suite 145, Troy, MI 48084.
Internet: <http://www.aves.org>
- National Automobile Dealers Association, 8400 Westpark Dr., McLean, VA 22102.
Internet: <http://www.nada.org>
- National Institute for Automotive Service Excellence, 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175.
Internet: <http://www.asecert.org>

Blue-Collar Worker Supervisors

SOC CODES: 47-1011, 49-1011, 51-1011, 53-1011, 53-1021 and 53-1031

Significant Points

- Employers prefer to promote applicants with postsecondary technical degrees.
- Organizational restructuring and technological developments will moderate employment growth.
- Over one-third worked for manufacturing companies.

Nature of the Work

- *Blue-collar worker supervisors* oversee the work of construction, maintenance, production, and transportation workers. Although duties are varied, a supervisor's primary task is to ensure that workers, materials, and equipment are used properly to maximize productivity.
- Computers are used to schedule procedures, monitor worker output, track materials, update inventory, and perform other supervisory tasks.
- Supervisors inform workers about company policies, provide employee reviews and recommend disciplinary action. They also meet regularly with management to report any problems and discuss possible solutions.

Working Conditions

- Blue-collar worker supervisors usually start the day early and stay late. They may work any shift, as well as weekends and holidays.
- Work environments vary with industry. Many work on a shop floor, where they spend most of the day on their feet. Others work outdoors even in severe weather conditions.
- Organizational restructuring and downsizing have increased supervisor responsibilities. Therefore, on-the-job stress has also increased.

Employment

- Blue-collar worker supervisors held about 2.4 million jobs in 2004 in the United States and approximately 86,060 jobs in Pennsylvania.
- Although found in almost all industries, the majority of blue-collar worker supervisors were found in manufacturing establishments. Others were employed in construction and transportation.
- The following table includes the industry groups that employed the most blue-collar worker supervisors in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	29,140	33.9%
Construction	13,810	16.1%
Wholesale & Retail Trade	10,420	12.1%
Transportation	6,750	7.8%
Government	5,520	6.4%
Self-Employed	4,730	5.5%

Job Outlook

- Employment of blue-collar worker supervisors in Pennsylvania is expected to decrease from approximately 86,060 in 2004 to approximately 89,050 in 2014. Blue-collar worker supervisors can expect about 335 openings due to growth and about 1,829 replacement openings for approximately 2,164 total annual openings.
- Projected job growth varies by industry. For the most part, as the number of blue-collar workers increases, so will the need for supervisors. However, organizational restructuring and technological developments will help moderate employment growth.
- Because of their skill and seniority, blue-collar worker supervisors are usually protected from layoffs during periods of economic decline.

Earnings

- In Pennsylvania, blue-collar worker supervisors averaged \$34,900 to \$57,400 annually in 2005. Entry-level wages were between \$21,900 and \$36,200, while experienced blue-collar worker supervisors earned anywhere from \$41,400 to \$68,000.
- The following table includes the average annual, entry level, and experienced level wages in 2005 for different blue-collar worker supervisors in Pennsylvania.

Occupational Title	Average Annual Wage	Entry Level Wage	Experienced Level Wage
Supervisors - Construction Trades & Extraction Workers	\$57,370	\$36,120	\$68,000
Supervisors - Mechanics, Installers & Repairers	\$54,890	\$35,730	\$64,460
Supervisors - Production & Operating Workers	\$51,020	\$33,370	\$59,840
Aircraft Cargo Handling Supervisors	\$34,970	\$21,980	\$41,460
Supervisors - Helpers, Laborers & Material Movers, Hand	\$45,040	\$28,620	\$53,260
Supervisors - Trans. & Material-Moving Machine/Vehicle Oprs	\$51,540	\$32,420	\$61,110

Training, Other Qualifications and Advancement

When choosing a supervisor, employers look for well-rounded workers who are knowledgeable and organized. Those who are able to motivate employees, maintain morale and command respect have the best advancement opportunities. Strong communication and interpersonal skills are extremely important attributes.

Although the minimum educational requirement is a high school diploma, many organizations prefer to promote applicants with post-secondary technical degrees. In fact, supervisors in highly technological industries may need a bachelor's degree. Regardless of their previous education, workers receive additional training in human resources, computer software, and management before advancing into a supervisory position.

Training requirements for advanced opportunities beyond a supervisory level differ by industry. Supervisors in manufacturing companies usually need a business or engineering degree and in-house training to advance to department head or production manager. In the construction industry, a degree in construction management or engineering is often needed to become a project manager, operations manager, or general superintendent. Some blue-collar worker supervisors eventually open their own businesses.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of blue-collar supervisors include those who supervise professional, technical, sales, clerical, and service workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Management Association, 1601 Broadway, New York, NY 10019. Internet: <http://www.amanet.org>
- National Management Association, 2210 Arbor Blvd., Dayton, OH 45439. Internet: <http://www.nma1.org>
- American Institute of Constructors, 466 94th Ave. N., St. Petersburg, FL 33702. Internet: <http://www.aicnet.org>

Coin, Vending & Amusement Machine Servicers & Repairers

SOC CODE: 49-9091

Significant Points

- Employers prefer applicants with a high school diploma and some mechanical ability.
- Opportunities should be good for those with knowledge of electronics.
- Additional vending and amusement machines will likely be added to meet the public demand.

Nature of the Work

- Coin, vending & amusement machine workers install, service, and stock vending and amusement machines.
Vending machine servicers, often called route drivers, collect money, restock merchandise, and change labels to indicate new selections. They also keep the machines clean and appealing.
Vending machine repairers make sure the machines operate correctly. They make the necessary water and electrical connections when installing machines. When dealing with machines that dispense food, workers must comply with State and local public health and sanitation standards.
Amusement machine servicers and repairers update selections, repair, or replace malfunctioning parts and rebuild jukeboxes, video games, pinball machines, and slot machines. Those in the gaming industry must adhere to strict State and Federal guidelines.
- Hand held diagnostic computers are used to determine the extent and location of any problem. The repairer decides if the machine can be fixed on-site or if it must be sent to the repair shop.
- Vending machine workers employed by small companies usually stock machines, collect money, fill change mechanisms, and repair machines when necessary.
- Servicers & repairers also file reports, prepare cost estimates, order parts, and keep records of merchandise distributed. However, new machines with computerized inventory controls greatly reduce this paperwork.

Working Conditions

- A 40-hour week is common for coin, vending & amusement machine servicers & repairers. Because vending and amusement machines operate around the clock, repairers often work at night, on weekends, and during holidays. They generally receive premium pay for any overtime work.
- Coin, vending & amusement machine servicers spend most of their time traveling between machine locations. Machine repairers primarily work in repair shops, but may spend time visiting machines on-site.
- Repair shops are generally quiet, well-lit, and spacious. However, on-site locations may be heavy pedestrian traffic areas and cramped spaces.
- Servicers & repairers must follow safe work procedures and take care to avoid hazards such as electrical shocks and cuts from sharp tools.

Employment

- Coin, vending & amusement machine servicers & repairers held about 45,600 jobs in 2004 in the United States and approximately 1,670 jobs in Pennsylvania.
- Twenty-nine percent worked for vending companies. More than 13 percent were self-employed. Another 12 percent worked for beverage manufacturing companies that have their own vending machines.
- The following table includes the industries that employed the most coin, vending & amusement machine servicers & repairers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Vending Machine Operators	480	29.0%
Self-Employed	220	13.1%
Beverage Manufacturing	200	12.0%
Other Amusement & Recreation Industries	200	12.0%
Grocery Product Merchant Wholesalers	100	5.7%

Job Outlook

- Employment of coin, vending & amusement machine workers in Pennsylvania is expected to decrease from approximately 1,670 in 2004 to approximately 1,480 in 2014. About 41 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Establishments are likely to install additional vending and amusement machines to meet the public demand.
- Improved technology will moderate employment growth. New machines need repairing and restocking less often and can even signal the company when service is required. This allows workers to be dispatched only when needed, instead of checking all machines on a regular schedule.
- People with a background in electronics should have good job prospects, because electronic circuitry is an important component of vending and amusement machines. If firms cannot find trained or experienced workers, they are likely to train qualified route drivers.

Earnings

Average hourly earnings of coin, vending & amusement machine servicers & repairers in Pennsylvania were \$13.56 in 2005. The entry-level rate in 2005 was \$8.21 while an experienced repairer made \$16.24.

Training, Other Qualifications and Advancement

Employers normally prefer to hire high school graduates for entry-level positions. Applicants may be required to demonstrate their mechanical ability through work experience or by scoring well on mechanical aptitude tests. As electronics become more prevalent in vending and amusement machines, employers increasingly prefer applicants who have some training in electronics.

Courses in electricity, refrigeration, and machine repair give potential applicants an advantage. Some vocational high schools and junior colleges offer one-to-two-year training programs in basic electronics. Also, the National Automatic Merchandising Association has a self-study training program for vending machine repairers. Upon completion of the program, repairers must pass a written test in order to become certified as a journey or master mechanic.

New workers start training with simple jobs, such as cleaning or stocking machines, and advance to rebuilding machines. Next, they accompany an experienced worker on service calls and finally make visits on their own. This process takes anywhere from six months to three years, depending on the individual's abilities, previous education, types of machines serviced, and quality of instruction.

To learn about new machines, repairers and servicers attend training sessions sponsored by manufacturers. These sessions may last a few days or several weeks. Coin, vending & amusement machine servicers & repairers often take evening courses in basic electricity, electronics, microwave ovens and refrigeration to keep aware of new techniques and equipment.

Machine servicers and repairers should be honest, since they often deal with large sums of money. They should also have the ability to deal tactfully with people. A commercial driver's license and a good driving record are essential. Skilled workers may be promoted to supervisory jobs or go into business for themselves.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of coin, vending & amusement machine servicers & repairers include electrical & electronics installers and repairers; electronic home-entertainment equipment installers & repairers; and heating, air-conditioning & home appliance repairers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- National Automatic Merchandising Association, 20 N. Wacker Dr., Suite 3500, Chicago, IL 60606-3102. Internet: <http://www.vending.org>

Computer, Automated Teller & Office Machine Repairers

SOC CODES: 49-2011

Significant Points

- Employers prefer to hire applicants who possess a working knowledge of electronics.
- Certified repairers may have an advantage over other candidates.
- Employment growth will be driven by the increasing dependence on these machines.

Nature of the Work

- **Computer repairers** provide hands-on repair service to mainframe and personal computers as well as printers and other peripheral equipment.
- **Automated teller machine (ATM) repairers** maintain and repair automated teller machines.
- When installing equipment, computer and automated teller machine repairers connect the communication lines that allow the transmission of information over computer networks. Workers may also install operating software and peripheral equipment.
- **Office machine repairers** provide service to photocopiers, cash registers, mail processing equipment, fax machines, and typewriters.
- **Field** technicians travel to customers' workplaces or ATM locations to make the necessary repairs. These workers often have assigned areas where they perform preventive maintenance. **Bench** technicians repair defective components brought into repair shops by field technicians and customers. In small companies, repairers may work in the repair shops and at customer locations.
- Workers use a variety of tools for diagnostic testing and repair, including computer software programs.

Working Conditions

- Computers and ATM repairers may have to work evenings, weekends or holidays. Shifts are usually assigned on the basis of seniority. Office machine repairers, on the other hand, usually work regular business hours.
- Bench technicians usually work in clean, well-lit surroundings. Repair shops are usually air-conditioned and well ventilated to protect the computers and office machines.
- Field technicians travel to various locations. ATM repairers may have to work in small, confined spaces.
- Although their job is not strenuous, repairers must lift equipment and work in a variety of postures. Preventive measures must be taken to avoid electrocution. Workers may also have to wear protective goggles.

Employment

- Computer, ATM & office machine repairers held about 167,600 jobs in 2004 in the United States and approximately 7,140 jobs in Pennsylvania.
- About 28 percent worked for wholesalers of commercial equipment. More than 18 percent were employed with electronics & appliance stores. About 1 in 10 were self-employed.
- The following table includes the industries that employed the most computer, ATM & office machine repairers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Commercial Goods Merchant Wholesalers	2,000	28.1%
Electronics & Appliance Stores	1,310	18.3%
Self-Employed	720	10.1%
Electronic Equipment Repair/Maintenance	660	9.3%
Office Supply, Stationery & Gift Stores	450	6.3%

Job Outlook

- Employment of computer, ATM & office machine repairers in Pennsylvania is expected to grow from approximately 7,140 in 2004 to approximately 7,490 in 2014. These repairers can expect about 35 openings due to growth and about 87 replacement openings for approximately 122 total annual openings.

- Employment growth of computer & ATM repairers is expected to grow as fast as average, as reliance on computers and ATMs continues to increase.
- Conventional office machines are inexpensive and often replaced instead of repaired. However, office machine repairers will still be needed for sophisticated office equipment, such as digital copiers.

Earnings

Average hourly earnings of computer, ATM & office machine repairers in Pennsylvania were \$18.99 in 2005. The entry-level rate in 2005 was \$12.68 while an experienced repairer made \$22.15.

Training, Other Qualifications and Advancement

A working knowledge of electronics is necessary for employment as a computer, ATM & office machine repairer. Strong communications skills, a neat appearance, and a valid driver's license are also required for field technicians. Employers prefer applicants with these qualities and formal training in electronics from associate degree programs, vocational schools, or equipment manufacturers. Certified computer repairers may have an advantage over other applicants.

Several organizations administer certification programs for computer repairers. A+ Certification is available through the Computing Technology Industry Association (CompTIA). Candidates must pass two tests, which assess basic computer repair skills, to receive the certification. The International Society of Certified Electronics Technicians (ISCET) and the Electronics Technicians Association (ETA) also administer certification programs. To receive certification, repairers must pass qualifying exams corresponding to their level of training and experience. Both programs offer associate certifications to entry-level repairers.

Entry-level repairers are expected to have a basic understanding of equipment repair when they are hired. Employers usually provide some on-the-job training as well. Newly hired computer repairers generally work on personal computers and peripheral equipment. With experience, they advance to more sophisticated equipment. Continuing education is very important and experienced workers are often sent to training sessions that discuss changes in technology and service procedures.

Experienced repairers may become specialists or troubleshooters, who help diagnose difficult problems. Others work with engineers on design and development. Field repairers of ATMs may be promoted to bench technician positions. Because of their familiarity with equipment, repairers can also move into customer service or sales positions. Those with leadership ability may move into management positions. Some decide to open their own repair shops or become wholesalers or retailers of electronic equipment.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of computer, ATM & office machine repairers include broadcast and sound technicians, electronic home entertainment equipment repairers, electronic repairers, industrial machinery repairers, and telecommunications equipment workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Computing Technology Industry Association, 1815 S. Meyers Rd., Suite 300, Oakbrook Terrace, IL 60181-5228. Internet: <http://www.comptia.org>
- The International Society of Certified Electronics Technicians, 3608 Pershing Ave., Fort Worth, TX 76107-4527. Internet: <http://www.iscet.org>
- Electronics Technicians Association, 5 Depot St., Greencastle, IN 46135. Internet: <http://www.eta-sda.com>

Diesel Engine Technicians & Mechanics

SOC CODE: 49-3031

Significant Points

- Opportunities should be best for graduates of a formal training program.
- High wages and the challenge of skilled repair work attract many people to this occupation.
- Voluntary certification is available.

Nature of the Work

- *Diesel engine technicians & mechanics* are responsible for repairing and maintaining the diesel engines that are found in transportation equipment, such as heavy trucks, buses, locomotives, bulldozers, cranes, road graders, farm tractors and boats.
- As more electronic components are used to control diesel engine operation, maintenance becomes more complex. Many diesel mechanics use handheld computers to diagnose problems and adjust engine functions.
- It is common for diesel mechanics to perform many different kinds of repairs. They use a variety of tools, including power tools, machine tools, welding equipment, jacks, and hoists. Common hand tools are used to work on small parts and hard-to-reach places.

Working Conditions

- Diesel mechanics usually work a 40-hour week. However, some work up to 70 hours. In fact, many shops have extended their hours as a convenience to their customers.
- Most work is performed indoors, although occasional repairs must be made on the road. Repair shops are normally well-lit, well ventilated, and heated. However, some are drafty and noisy.
- Mechanics may have to lift heavy materials, handle greasy parts, or maneuver into awkward positions.
- Minor cuts, burns, and bruises are common. If the shop is kept clean and safety procedures are followed, serious accidents can usually be avoided.

Employment

- Diesel engine technicians & mechanics held about 270,100 jobs in 2004 in the United States and approximately 15,090 jobs in Pennsylvania.
- Almost 28 percent worked for transportation and warehousing establishments, primarily general trucking companies. Others worked in automotive repair shops and for local government agencies.
- The following table includes the industries that employed the most diesel engine technicians & mechanics in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
General Freight Trucking	1,860	12.3%
Automotive Repair & Maintenance	1,310	8.7%
Local Government	1,220	8.1%
Automotive Equipment Rental & Leasing	970	6.4%

Job Outlook

- Employment of diesel engine technicians & mechanics in Pennsylvania is expected to grow from approximately 15,090 in 2004 to approximately 16,560 in 2014. Diesel mechanics can expect about 148 openings due to growth and about 388 replacement openings for approximately 536 total annual openings.
- The durability and economy of the diesel engine will encourage its use in buses and trucks of all sizes. As a result, additional diesel mechanics will be needed.
- High wages and the challenge of skilled repair work attract many people to this occupation. Opportunities should be best for graduates of a formal training program. Those without formal training may face competition for entry-level jobs.

Earnings

Average hourly earnings of bus & truck mechanics & diesel engine specialists in Pennsylvania were \$17.03 in 2005. The entry-level rate in 2005 was \$11.75 while an experienced diesel engine specialist made \$19.66.

Training, Other Qualifications and Advancement

Employers generally prefer to hire graduates who have formal training because of their head start in training and their ability to quickly advance to the journey mechanic level. Diesel engine repair programs are offered at community colleges, trade schools, and vocational schools. Training programs, which last anywhere from six to 24 months, combine hands-on training with classroom instruction. Employers work closely with training facilities to provide instructors with the latest equipment, tools, and techniques. Upon completion of the program, graduates receive a certificate or associate's degree.

Some diesel mechanics still learn their skills through on-the-job training. When hiring entry-level workers, employers look for high school graduates who are at least 18 years old and in good physical health. Applicants must have mechanical aptitude and strong problem solving skills. In addition, a commercial driver's license is required to test drive trucks and buses on public roads. Previous courses in automotive repair, electronics, English, mathematics, and physics provide a strong knowledge base. Unskilled workers are assigned to simple tasks, such as cleaning parts and fueling vehicles. After gaining experience, they are promoted to trainee mechanic positions. In general, it requires three to four years of on-the-job training to qualify as a journey-level mechanic.

Voluntary certification is available through the National Institute for Automotive Service Excellence (ASE). Diesel mechanics may be certified in any or all of six repair areas, including brakes, gasoline engines, diesel engines, drive trains, electrical systems, or suspensions. To earn ASE certification, applicants must pass at least one examination and have two years of hands-on experience. Two years of relevant training may be substituted for up to one year of work experience. Applicants who pass all six examinations are awarded the designation of ASE Master Heavy-Duty Truck Technician. A diesel mechanic may elect to become a certified school bus technician as well. To retain any certification, workers must retake the examination every five years. Therefore, it is essential for diesel mechanics to keep abreast of any technological advances.

Personal tools are very important to diesel mechanics. Although employers furnish power tools and computerized diagnostic equipment, workers are expected to accumulate their own hand tools. Experienced mechanics have invested thousands of dollars in their tools.

Experienced diesel mechanics with supervisory ability may advance to shop supervisor or service manager positions. Others take positions as sales representatives. Some open their own repair shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of diesel engine mechanics include mechanics that repair aircraft, vehicles, farm equipment, boat engines and mobile heavy equipment.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- American Trucking Associations, 2200 Mill Rd., Alexandria, VA 22314-4677. Internet: <http://www.truckline.com>
- National Institute for Automotive Service Excellence, 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Internet: <http://www.asecert.org>
- National Automotive Technicians Education Foundation, 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Internet: <http://www.natfef.org>

Electrical & Electronics Installers & Repairers

SOC CODE: 49-2092, 49-2093, 49-2094, 49-2095 and 49-2096

Significant Points

- Job opportunities should be best for those with knowledge of electronics and previous repair experience.
- Training programs are offered at vocational schools and community colleges.

Nature of the Work

- **Electrical & electronics installers & repairers** are responsible for the installation and maintenance of equipment used for production control, communication, and national defense.
Field technicians travel to the customer's location to repair equipment. In addition, they often have assigned areas where they perform preventive maintenance on a regular basis.
Bench technicians work in repair shops that are located in factories and service centers. They work on components that cannot be repaired on the factory floor.
- When equipment breaks down, repairers first check for common causes of trouble. If routine checks do not locate the trouble, software programs and testing equipment may be used to diagnose malfunctions. Hand tools are then used to replace parts and adjust equipment.
- Some modern equipment is self-monitoring and automatically alerts repairers to any malfunctions.

Working Conditions

- Because electronic equipment is critical, repairers work around the clock. Shifts may include evening, weekend, and holiday hours. Schedules are usually assigned on the basis of seniority.
- Many electronics repairers work on hot, noisy factory floors. Bench technicians work primarily in comfortable, well-lit repair shops that are relatively quiet. On the other hand, field technicians spend much time on the road.
- Strict safety guidelines must be followed to reduce the risk of injury. Repairers often wear protective goggles and hardhats. When working on ladders, they may wear harnesses to prevent falls.

Employment

- Electrical & electronics installers & repairers held about 157,900 jobs in 2004 in the United States and approximately 6,230 jobs in Pennsylvania.
- Over 20 percent worked for manufacturing establishments. Another 14 percent were employed with utility companies, primarily those that generate and supply power.
- The following table includes the industry groups that employed the most electrical & electronics installers & repairers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	1,278	20.5%
Utilities	895	14.4%
Other Services	803	12.9%
Transportation & Warehousing	656	10.5%
Construction	591	9.5%

Job Outlook

- Employment of electrical & electronics installers & repairers in Pennsylvania is expected to decrease from approximately 6,230 in 2004 to approximately 6,120 in 2014. About 160 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Employment levels within Federal government agencies will decline as repair work is outsourced to outside contractors. However, repairers will find many opportunities within private industry. Job opportunities should be best for applicants with a thorough knowledge of electronics and previous repair experience.
- The use of automated commercial and industrial equipment will become more widespread as businesses strive to lower costs. As a result, companies will rely on electronics repairers to keep this equipment operational.

Earnings

- In Pennsylvania, electrical & electronics installers & repairers averaged \$18.70 to \$25.50 per hour in 2005. Entry-level rates were between \$12.30 and \$20.60 per hour, while experienced repairers earned anywhere from \$21.90 to \$27.90 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for electrical & electronics installers & repairers in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Electric Motor & Power Tool Repairers	\$18.76	\$12.30	\$21.98
Electrical & Electronics Repairers, Transportation Equip.	\$19.80	\$14.67	\$22.36
Electrical & Electronics Repairers, Commercial & Industrial Equip.	\$20.71	\$14.20	\$23.97
Electrical & Electronics Repairers, Powerhouse, Substation, & Relay	\$25.45	\$20.57	\$27.88
Electronic Equipment Installers & Repairers, Motor Vehicles	N/A	N/A	N/A

- No Pennsylvania-specific information was available for motor vehicle electronic equipment installers & repairers. However, the average hourly wage nationwide for these repairers in 2005 was \$14.94.

Training, Other Qualifications and Advancement

Knowledge of electronics is necessary for employment as an electronics repairer of commercial and industrial equipment. Many applicants gain this knowledge through formal programs offered at vocational schools and community colleges. These training programs usually last one to two years. Upon graduation, entry-level repairers often work closely with experienced technicians.

Electronics repairers must have good eyesight and accurate color perception in order to work with the intricate components found in electronic equipment. Field technicians should also have good communications skills, a neat appearance, and a valid driver's license.

The International Society of Certified Electronics Technicians (ISCET) and the Electronics Technicians Association (ETA) administer certification programs for electronics technicians. Certification is awarded to individuals who pass the qualifying exams, which correspond to their level of training and experience. Both of these programs also offer associate certifications to entry-level repairers.

Experienced repairers with advanced training may move into higher paying jobs, such as specialists or troubleshooters. Those with leadership ability may advance to supervisor positions. Some experienced workers open their own repair shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of electrical & electronics installers & repairers include broadcast technicians, sound technicians, millwrights, and repairers of a variety of equipment, including computers, ATMs, office machines and electronic home entertainment devices.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- The International Society of Certified Electronics Technicians, 3608 Pershing Ave., Fort Worth, TX 76107. Internet: <http://www.iscet.org>
- Electronics Technicians Association, 5 Depot St., Greencastle, IN 46135. Internet: <http://www.eta-sda.com>

Electronic Home Entertainment Equipment Repairers

SOC CODE: 49-2097

Significant Points

- Employers prefer to hire applicants who have a basic knowledge of electronics.
- Inexpensive home entertainment equipment will cause a decline in the demand for repairers.
- Opportunities will be best for those with previous hands-on experience and technical knowledge of electronics.

Nature of the Work

- **Electronic home entertainment equipment repairers** (also called *service technicians*) fix televisions, radios, stereo components, VCR's, videodisc players, CD players and video cameras. They may also repair home security systems, intercom equipment, and home theater equipment.
- **Bench technicians** repair small, portable items that customers bring into the repair shop for servicing. When larger mobile equipment breaks down, **field technicians** travel to the customer's home to repair the item. Field technicians may bring defective components back to the repair shop for a thorough diagnosis and repair.
- Repairers use a variety of testing equipment to diagnose and identify malfunctions. Common causes of trouble include dirty or defective components.

Working Conditions

- Bench technicians usually work in clean, well-lit repair shops.
- Field technicians spend their time traveling in service vehicles and working in customers' residences.
- Although their job is not strenuous, repairers may have to carry heavy equipment and work in a variety of postures. Preventive measures must be taken to avoid minor burns and electric shock.

Employment

- Electronic home entertainment equipment repairers held about 46,900 jobs in 2004 in the United States and approximately 2,430 jobs in Pennsylvania.
- More than 26 percent worked in retail electronics & appliance stores, which sell and service radios and televisions. About 23 percent were self-employed.

Job Outlook

- Employment of electronic home entertainment equipment repairers in Pennsylvania is expected to grow from approximately 2,430 in 2004 to approximately 2,520 in 2014. Electronic home entertainment equipment repairers can expect about 9 openings due to growth and about 48 replacement openings for approximately 57 total annual openings.
- Opportunities will be best for applicants with hands-on experience and knowledge of electronics.
- It is often cheaper for consumers to replace equipment than to pay for the repairs, but some electronic home entertainment equipment repairers will be needed to maintain sophisticated equipment, such as digital televisions. This need will not offset the overall decline in demand for repairers.

Earnings

Average hourly earnings of electronic home entertainment equipment repairers in Pennsylvania were \$13.15 in 2005. The entry-level rate in 2005 was \$9.15 while an experienced repairer made \$15.15.

Training, Other Qualifications and Advancement

Knowledge of electronics is necessary for employment as an electronic home entertainment equipment repairer. Familiarity with schematics and some hands-on experience repairing electronic equipment are also beneficial. Field technicians must have strong communications skills, a neat appearance, and a valid driver's license. Employers prefer applicants with these qualities and formal training in electronics from vocational schools or community colleges.

The International Society of Certified Electronics Technicians (ISCET) and the Electronics Technicians Association (ETA) administer certification programs. To receive certification, repairers must pass qualifying exams corresponding to their level of training and experience. Both programs offer associate certifications to entry-level electronic home entertainment equipment repairers.

Entry-level repairers work closely with more experienced workers who provide technical guidance. Experienced repairers with advanced training may become specialists or troubleshooters, who help others diagnose difficult problems. Those with leadership ability may become supervisors. Some open their own repair shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of electronic home entertainment equipment repairers include broadcast & sound technicians; computer, ATM & office machine repairers; electrical & electronics repairers; and radio & telecommunications equipment installers & repairers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- The International Society of Certified Electronics Technicians, 3608 Pershing Ave., Fort Worth, TX 76107-4527. Internet: <http://www.iscet.org>
- Electronics Technicians Association, 5 Depot St., Greencastle, IN 46135. Internet: <http://www.eta-sda.com>

Farm Equipment Mechanics

SOC CODE: 49-3041

Significant Points

- Opportunities should be best for graduates of formal training programs.
- Increasingly sophisticated farm equipment requires new skills.
- Overtime work is common during the planting and harvesting seasons.

Nature of the Work

- *Farm equipment mechanics*, often called service technicians, service, maintain, and repair farm equipment as well as smaller lawn and garden tractors.
- Because modern farm machinery has grown in size, complexity, and variety, many farmers have turned to farm equipment mechanics to service and repair their equipment.
- Farm equipment mechanics usually work on equipment brought into the shop but they may travel to farms to make emergency repairs. They perform preventive maintenance on older equipment to keep them in proper working order. In addition, some mechanics assemble new machinery or do body work.
- Mechanics use hand tools, power tools, welding equipment, and precision equipment to repair broken parts. Computerized diagnostic equipment is often used to monitor and locate malfunctions in more advanced equipment. This computerized equipment requires a traditional farm equipment mechanic acquire new skills.

Working Conditions

- Farm equipment mechanics often work six or seven days a week, 10 to 12 hours a day during the busy planting and harvesting seasons. In slower months, mechanics may work fewer than 40 hours a week.
- Most farm equipment mechanics work in repair shops that are heated, well-lit, and adequately ventilated. Some repairs must be done in the farmer's equipment shed or barn where conditions may not be as ideal.
- Farm equipment mechanics handle greasy and dirty parts and may have to stand or lie in awkward positions to repair equipment. They often lift heavy items and handle agricultural chemicals and solutions. Minor cuts, burns, and bruises are common, but serious accidents can be avoided when safety practices are observed.

Employment

- Farm equipment mechanics held about 32,600 jobs in 2004 in the United States and approximately 1,130 jobs in Pennsylvania.
- About 78 percent worked in the service departments of wholesale and retail farm machinery, equipment and supply dealers.

Job Outlook

- Employment of farm equipment mechanics in Pennsylvania is expected to grow from approximately 1,130 in 2004 to approximately 1,230 in 2014. Farm equipment mechanics can expect about 10 openings due to growth and about 25 replacement openings for approximately 35 total annual openings.
- Opportunities should be good for farm equipment mechanics that have completed formal training programs. Employers report difficulty finding qualified candidates to fill available positions because people trained to repair farm equipment have the fundamental skills to work as mechanics in industries outside agriculture.
- Although farmland will be consolidated and farmers will need less equipment in the years ahead, the increased complexity of the new farm equipment will require well-trained mechanics.

Earnings

- Average hourly earnings of farm equipment mechanics in Pennsylvania were \$14.53 in 2005. The entry-level rate in 2005 was \$9.04 while an experienced mechanic made \$17.27.
- Overtime work is common during the planting and harvesting seasons and generally pays time and a half.

Training, Other Qualifications and Advancement

Employers prefer to hire farm equipment mechanics that have completed a postsecondary training program in agricultural or farm mechanics. Most enter the occupation as trainees and become proficient by assisting experienced mechanics. About two years of on-the-job training is necessary for a mechanic to do routine repair work efficiently. Highly specialized repair and overhaul jobs may require additional training. Others applicants enter this

occupation through related careers, such as diesel mechanic, mobile heavy equipment mechanic, or automotive mechanic. Prior experience in farm work or a military background in mechanics can provide a foundation for the skills and training necessary to become a farm equipment mechanic.

Farm equipment mechanics must have mechanical ability and the strength to lift, move, or hold heavy parts in place. Problem-solving skills are needed to diagnose the malfunction and choose the correct course of action to repair the problem. Strong computer skills and the aptitude to read circuit diagrams and blueprints are needed in order to make complex repairs. Experienced farm equipment mechanics should be able to work independently with minimal supervision.

Personal tools are very important to farm equipment mechanics. Although employers furnish power tools and computerized test equipment, trainee farm equipment mechanics are expected to accumulate their own hand tools. Experienced mechanics have invested thousands of dollars in their tools.

Experienced farm equipment mechanics may advance to shop supervisor, service manager, or dealership manager positions. A few become service representatives for farm equipment manufacturers. Some open their own repair shops or invest in franchised dealers.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of farm equipment mechanics include aircraft, automotive, diesel engine and mobile heavy equipment mechanics.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- North American Equipment Dealers Association, 1195 Smizer Mill Rd., Fenton, MO 63026. Internet: <http://www.naeda.com>

Handlers, Equipment Cleaners, Helpers & Laborers

SOC CODES: 47-2061, 47-3011, 47-3012, 47-3013, 47-3014, 47-3015, 47-3016, 47-5081, 49-9098, 51-9198, 53-6021, 53-6031, 53-7061, 53-7062, 53-7063, 53-7064 and 53-7081

Significant Points

- Most jobs are entry-level and require no formal training.
- Projected employment growth varies by occupation.

Nature of the Work

- Handlers, equipment cleaners, helpers, and laborers (called general laborers going forward) perform tasks that are needed to make the work of skilled construction, maintenance, and production workers flow smoothly.
- To perform their jobs effectively, general laborers must be familiar with the work of those they are assisting.

Construction craft laborers provide much of the physically demanding labor at construction sites. They may prepare sites, dig trenches, mix concrete, or set explosives.

Freight, stock, and material movers use forklifts, dollies, carts, and manual power to move materials between storage and production areas.

Hand packers and packagers manually pack, package, or wrap a variety of materials. They may inspect items, label cartons, and stack packages.

Helpers assist skilled workers. They may fetch tools, hold materials, or clean work areas.

Machine feeders and offbearers are responsible for feeding or removing materials from machines.

Parking lot attendants assist customers in parking their cars and collect parking fees.

Refuse and recyclable material collectors gather trash, garbage, and recyclables from homes and businesses along a regularly scheduled route. They also transport the refuse to the dump, landfill, or recycling center.

Service station attendants fill fuel tanks and wash windshields on vehicles. They may perform simple repairs under the direction of a mechanic.

Vehicle washers and equipment cleaners use water and various cleaning equipment to maintain machinery, vehicles, storage tanks, pipelines, and similar equipment.

Working Conditions

- Although work schedules vary with industry, most general laborers work 8-hour shifts. Early morning, evening, and “graveyard” shifts are common.
- General laborers do repetitive, physically demanding work. They may work at great heights or in tight, awkward places. Some laborers work outdoors in all weather conditions.
- These employees wear safety clothing and hard hats to avoid against injury. Because they may be exposed to harmful materials or chemicals, some workers wear protective devices over their eyes, mouth, and ears.

Employment

- General laborers held about 6.2 million jobs in 2004 in the United States and approximately 253,580 jobs in Pennsylvania.
- Nearly one-quarter worked for manufacturing companies. About 18 percent were employed in the construction industry and roughly 17 percent in service-providing establishments.
- The following table includes the industry groups that employed the most general laborers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Manufacturing	60,170	23.7%
Construction	44,660	17.6%
Services	41,910	16.5%
Retail Trade	36,600	14.4%
Transportation & Warehousing	27,800	11.0%

Job Outlook

- Employment of general laborers in Pennsylvania is expected to decrease from approximately 253,580 in 2004 to approximately 252,670 in 2014. About 7,425 annual openings will result from replacement needs. Although no net employment growth is expected for general laborers, growth openings may occur in some specific occupations and certain regions.
- Equipment cleaners, hand packers, parking lot attendants, construction helpers, and refuse material collectors will have the best employment prospects. Service station attendants and machine feeders can expect declines in employment levels.
- Employment growth will be limited by automation, out-sourcing, and job combination. All of these factors increase productivity and improve quality control. As a result, many jobs will be eliminated.

Earnings

- In Pennsylvania, general laborers averaged \$8.30 to \$15.10 per hour in 2005. Entry-level rates were between \$6.00 and \$9.40 per hour, while experienced laborers earned anywhere from \$9.40 to \$18.00 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for general laborers in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Construction Laborers	\$15.06	\$9.36	\$17.91
Helpers--Brick, Block & Stonemasons and Tile & Marble Setters	\$13.33	\$9.11	\$15.44
Helpers--Carpenters	\$10.93	\$8.29	\$12.25
Helpers--Electricians	\$12.52	\$8.08	\$14.74
Helpers--Painters, Paperhangers, Plasterers & Stucco Masons	\$11.30	\$7.61	\$13.15
Helpers--Pipelayers, Plumbers, Pipefitters & Steamfitters	\$12.00	\$8.71	\$13.65
Helpers--Roofers	\$10.85	\$7.88	\$12.34
Helpers--Extraction Workers	\$13.02	\$8.59	\$15.23
Helpers--Installation, Maintenance & Repair Workers	\$11.29	\$7.36	\$13.26
Helpers--Production Workers	\$11.40	\$7.74	\$13.23
Parking Lot Attendants	\$8.34	\$6.19	\$9.42
Service Station Attendants	\$8.32	\$6.00	\$9.48
Cleaners of Vehicles & Equipment	\$8.92	\$6.32	\$10.22
Laborers & Freight, Stock & Material Movers, Hand	\$11.61	\$7.65	\$13.59
Machine Feeders & Offbearers	\$12.07	\$8.29	\$13.97
Packers & Packagers, Hand	\$10.10	\$6.99	\$11.65
Refuse & Recyclable Material Collectors	\$13.82	\$8.63	\$16.41

Training, Other Qualifications and Advancement

Most general laborer positions are entry-level and do not require a high school diploma or any previous experience. However, most employers prefer to hire those who are at least 18 years old and physically able to perform the work. Applicants may have to take a physical exam, pass a drug test, or undergo a background check prior to employment.

Workers must be reliable and hard working. Basic reading and math skills are needed to understand procedure manuals and collect payments from customers. Grocery store baggers, service station workers, and parking lot attendants should be pleasant and courteous when dealing with the public.

Although most general laborers learn their skills through on-the-job training, formal apprenticeship programs are available in construction trades. These programs, which combine on-the-job training with classroom instruction, provide overall preparation. Apprentices are taught how to properly handle all tools and equipment.

Before an apprentice is placed on the job, most union contractors require some hands-on training. Likewise, workers who must handle toxic chemicals or operate dangerous equipment often receive additional training in safety awareness and procedures.

Experienced laborers often become trainees for skilled construction, maintenance, and production positions. In fact, most employers prefer to fill open slots with qualified workers from within the company. Some general laborers are promoted to supervisory positions.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of general laborers include roustabouts, forest workers, logging equipment operators, and groundskeepers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Carwash Association, 401 N. Michigan Ave., Chicago, IL 60611.
Internet: <http://www.carwashes.com>

General Maintenance & Repair Workers

SOC CODE: 49-9042

Significant Points

- Skills are gained through on-the-job training or job shadowing.
- Workers are employed in almost every industry so job openings should be plentiful.

Nature of the Work

- *General maintenance & repair workers* maintain and repair machines, mechanical equipment, and buildings and work on plumbing, electrical, and air-conditioning and heating systems.
- They inspect and diagnose problems and determine the best way to correct them, frequently checking blueprints, repair manuals, and parts catalogs.
- They also perform routine preventive maintenance and ensure that machines continue to run smoothly, building systems operate efficiently, and the physical condition of buildings does not deteriorate.

Working Conditions

- Most general maintenance workers work a 40-hour week. Some work evening, night, or weekend shifts or are on call for emergency repairs.
- General maintenance & repair workers often carry out several different tasks in a single day, at any number of locations. They may work inside of a single building or in several different buildings.
- They may have to stand for long periods, lift heavy objects, and work in uncomfortably hot or cold environments, in awkward and cramped positions, or on ladders. They are subject to electrical shock, burns, falls, cuts, and bruises.

Employment

- General maintenance & repair workers held about 1.3 million jobs in 2004 in the United States and approximately 58,550 jobs in Pennsylvania.
- These workers were found in almost every industry. About 40 percent worked in service-providing sectors, such as real estate and education. Manufacturing employed another 24 percent.
- The following table includes the industry groups that employed the most general maintenance & repair workers in 2004 in Pennsylvania.

Industry Group	2004 Employment	Percent
Services	22,870	39.1%
Manufacturing	14,030	24.0%
Real Estate	6,320	10.8%
Government	5,190	8.9%
Trade	3,480	5.9%

Job Outlook

- Employment of general maintenance & repair workers in Pennsylvania is expected to grow from approximately 58,550 in 2004 to approximately 62,220 in 2012. These workers can expect about 367 openings due to growth and about 1,124 replacement openings for approximately 1,491 total annual openings.
- General maintenance is a large occupation with significant turnover.
- Employment is related to the number of buildings and equipment needing maintenance and repair.
- As machinery becomes more advanced and requires less maintenance, the need for general maintenance & repair workers diminishes.

Earnings

Average hourly earnings of general maintenance & repair workers in Pennsylvania were \$15.50 in 2005. The entry-level rate in 2005 was \$10.03 while an experienced general maintenance & repair worker made \$18.23.

Training, Other Qualifications and Advancement

Many general maintenance & repair workers learn their skills informally on the job. They start as helpers, watching and learning from skilled maintenance workers. Necessary skills also can be learned in high school shop classes and postsecondary trade or vocational schools. It generally takes from one to four years of on-the-job training or school, or a combination of both, to become fully qualified, depending on the skill level required.

Because a growing number of new buildings rely on computers to control various of their systems, general maintenance & repair workers may need basic computer skills, such as how to log onto a central computer system and navigate through a series of menus. Usually, companies that install computer-controlled equipment provide on-site training for general maintenance and repair workers.

Graduation from high school is preferred for entry into this occupation. High school courses in mechanical drawing, electricity, woodworking, blueprint reading, science, mathematics, and computers are useful. Mechanical aptitude, the ability to use shop mathematics, and manual dexterity are important. Good health is necessary because the job involves much walking, standing, reaching, and heavy lifting. Difficult jobs require problem-solving ability, and many positions require the ability to work without direct supervision.

Many general maintenance & repair workers in large organizations advance to maintenance supervisor or become a craftworker such as an electrician, a heating and air-conditioning mechanic, or a plumber. Within small organizations, promotion opportunities are limited.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of general maintenance & repair workers include carpenters; pipelayers, plumbers, pipefitters & steamfitters; electricians; coin, vending & amusement machine servicers & repairers; heating, air-conditioning & refrigeration mechanics; electrical & electronics installers & repairers; electronic home entertainment equipment repairers; and radio & telecommunications equipment installers & repairers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Associated General Contractors of America, 1957 E St. NW, Washington, DC 20006.
Internet: <http://www.agc.org>

Home Appliance Repairers

SOC CODE: 49-9031

Significant Points

- Opportunities should be good for well-trained repairers with a background in electronics.
- Employers encourage formal training and certification.

Nature of the Work

- **Home appliance repairers**, often called *service technicians*, help maintain small home appliances, like microwaves, major home appliances, like refrigerators, gas appliances, and power tools. They also answer customers' questions about the care and use of appliances.
- Appliance and power tool repairers visually inspect items and check for unusual noises, excessive vibration, leaks, or loose parts. After identifying the problem, they replace or repair defective parts.
- Gas appliance repairers usually check the heating unit and replace any damaged parts. They may also answer emergency calls for gas leaks.
- When repairing refrigerators and air-conditioners, repairers must use care to conserve, recover, and recycle chlorofluorocarbon (CFC) and hydro-chlorofluorocarbon (HCFC) refrigerants used in their cooling systems as required by law.
- Home appliance repairers write up cost estimates for customers, record parts used and hours worked, prepare bills, and collect payments. They also document the capture and disposal of refrigerants.

Working Conditions

- Many home appliance repairers work a standard 40-hour week. They work morning, evening, or weekend shifts and often remain on-call in case of emergency. Overtime work is common in the spring and summer months, when breakdowns are more frequent.
- Small appliance repairers usually work in repair shops that are quiet, well-lit, and adequately ventilated. Major appliance repairers spend several hours a day driving to and from service calls. They may work in clean, comfortable rooms or dusty, cramped areas of the house.
- Although their job is not usually hazardous, repairers must follow safety precautions to avoid electrical shocks and other injuries. When repairing gas appliances and microwave ovens, they must be aware of the dangers of gas and radiation leaks.
- Home appliance repairers usually work with little or no supervision, a feature that appeals to many people.

Employment

- Home appliance repairers held about 49,800 jobs in 2004 in the United States and approximately 1,830 jobs in Pennsylvania.
- Electronic repair stores, household appliance shops and department stores employed the most home appliance repairers. About 1 in 8 were self-employed.
- The following table includes the industries that employed the most home appliance repairers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Electronics & Appliance Stores	440	23.8%
Household Goods Repair & Maintenance	380	20.8%
Self-Employed	240	13.4%
Department Stores	150	8.0%

Job Outlook

- Employment of home appliance repairers in Pennsylvania is expected to increase slightly from approximately 1,830 in 2004 to approximately 1,740 in 2014. About 43 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.

- The number of home appliances and power tools in use is expected to increase, however employment growth will be constrained as the frequency of repairs is reduced.
- Prospects should be good for well-trained repairers with a strong background in electronics.
- Jobs will most likely be concentrated in larger companies as many smaller shops, family owned businesses, and self-employed repairers are forced to join larger shops in order to stay abreast of developments in the industry.
- Employment is relatively steady because the demand for appliance repair services continues even during economic downturns.

Earnings

- Average hourly earnings of home appliance repairers in Pennsylvania were \$15.72 in 2005. The entry-level rate in 2005 was \$10.65 while an experienced home appliance repairer made \$18.25.
- Because many home appliance repairers receive commission along with their salary, earnings increase along with the number of jobs completed in a day.
- Larger establishments offer benefits such as health insurance, sick leave, and retirement and pension programs.

Training, Other Qualifications and Advancement

Employers require home appliance repairers have a high school diploma and mechanical aptitude. Applicants with formal training in appliance repair and electronics are preferred. Those who work in customers' homes must also be courteous and tactful.

Small appliance repairers commonly learn their trade on the job while major appliance repairers usually receive training from a trade school, community college, or the manufacturer. Regardless of how their basic skills are developed, trainees usually receive training from their employer as well. Small appliance repairers often work on a single type of appliance or tool until they master its repair and then move on to another. They continue in this manner until they can repair all appliances or tools handled by their shop. In companies that repair major appliances, new repairers assist experienced repairers on service visits. They learn to read schematic drawings, analyze problems, determine whether to repair or replace parts, and follow proper safety procedures. Up to three years of on-the-job training may be needed for a technician to become skilled in all aspects of repair. Some establishments have formal training programs that include home study and shop classes.

Experienced home appliance repairers receive supplemental instruction through seminars conducted by manufacturers. Those repairers authorized for warranty work are required to attend periodic training sessions. Furthermore, all repairers who buy or work with refrigerants must pass a written examination to become certified in its proper handling as mandated by the Environmental Protection Agency (EPA).

A growing number of employers encourage their home appliance repairers to become certified. Several organizations administer certification programs. The Association of Home Appliance Manufacturers has instituted the National Appliance Service Technician Certification Program (NASTeC). To become certified, repairers must pass a comprehensive examination testing their competence in the diagnosis, repair, and maintenance of major home appliances. The Professional Service Association (PSA) has a certification program similar to the NASTeC program. A repairer must pass an examination to become certified. The PSA certification is valid for 4 years and the repairer must complete 48 hours of instruction for renewal. Otherwise, they must retake the examination.

Repairers in large establishments may be promoted to supervisor, assistant service manager, or service manager. A few may advance to upper-level managerial positions. Preference is given to those who demonstrate technical competence and show leadership ability. Other repairers open their own repair shop.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of home appliance repairers include heating, air-conditioning & refrigeration mechanics; locksmiths; small-engine mechanics; office machine & cash register servicers; electronic home entertainment equipment repairers; and coin, vending & amusement machine servicers & repairers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Appliance Service News, PO Box 809, St. Charles, IL 60174. Internet: <http://www.asnews.com>
- United Servicers Association, Inc., 6428 Coldwater Canyon Ave., North Hollywood, CA 91606. Internet: <http://www.unitedservicers.com>
- National Appliance Service Association, P.O. Box 2154, Kokomo, IN 46904. Internet: <http://www.nasa1.org>
- National Appliance Service Technician Certification Program (NASTeC), 3608 Pershing, Ft. Worth, TX 76107. Internet: <http://www.nastec.org>
- Professional Service Association, 71 Columbia St., Cohoes, NY 12047. Internet: <http://www.psaworld.com>

Industrial Machinery Repairers

SOC CODES: 49-9041 and 49-9043

Significant Points

- Most skills are learned through formal apprenticeship programs.
- Applicants with broad skills in machine repair should have favorable job prospects.

Nature of the Work

- **Industrial machinery repairers** are responsible for the maintenance and repair of machinery in a plant or factory. They may also install and properly situate new machines.
- Malfunctioning machinery may result in production delays, damaged products, or injured operators. To minimize these problems, repairers must diagnose minor malfunctions and correct them before they become major ones. Once the problem has been fixed, the machinery is tested to ensure that it is operating correctly.
- Computerized diagnostic equipment and sophisticated machinery require industrial machinery repairers who have strong electronic and computer skills.

Working Conditions

- Many industrial machinery repairers average more than 40 hours per week. Emergency repairs may require overtime, evening, and weekend work.
- Protective equipment, such as hard hats, protective glasses, and safety belts, must be worn to protect against common shop injuries.

Employment

- Industrial machinery repairers held about 306,100 jobs in 2004 in the United States and approximately 13,770 jobs in Pennsylvania.
- Over 60 percent worked for manufacturing companies. Another 12 percent worked in the service-providing sector, which includes commercial machinery repairers.
- The following table includes the industries that employed the most industrial machinery repairers in 2004 in Pennsylvania.

Industry Group	2004	Percent
	Employment	
Manufacturing	8,350	60.6%
Services	1,650	12.0%
Trade	1,180	8.6%
Utilities	840	6.1%

Job Outlook

- Employment of industrial machinery repairers in Pennsylvania is expected to decrease from approximately 13,770 in 2004 to approximately 13,460 in 2014. About 288 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Although industrial machinery repairers will be needed to ensure that new machines are properly maintained and operational, many automated production machines are capable of self-diagnosis. This increases machine reliability and thereby reduces the need for repairers. However, applicants with broad skills in machine repair should have favorable job prospects.
- Because machines must be maintained regardless of production level, industrial machinery repairers are less affected by economic conditions than other manufacturing occupations. However, reduced hours and layoffs may occur during severe economic conditions.

Earnings

- Average hourly earnings of industrial machinery mechanics in Pennsylvania were \$18.99 in 2005. The entry-level rate in 2005 was \$14.10 while an experienced industrial machinery mechanic made \$21.44.

- Average hourly earnings of machinery maintenance workers in Pennsylvania were \$16.76 in 2005. The entry-level rate in 2005 was \$11.54 while an experienced machinery maintenance worker made \$19.37.

Training, Other Qualifications and Advancement

Industrial machinery repairers usually learn their trade through union-sponsored apprenticeship programs, which last four years and combine classroom instruction with on-the-job training. Others work as helpers and learn how to operate, assemble, repair, and disassemble machinery from experienced workers. Informal training is often supplemented with courses offered by machinery manufacturers and community colleges.

Aspiring industrial machinery repairers need mechanical aptitude and manual dexterity. Good physical conditioning and agility are needed to lift heavy objects and reach equipment located high above the floor. When hiring industrial machinery repairers, employers prefer high school graduates with previous experience in mechanical drawing, mathematics, blueprint reading, physics, computers, and electronics.

Although opportunities for advancement are limited, industrial machinery repairers can advance to more complicated equipment or to supervisor positions. The most highly skilled repairers can become tool and die makers, machinists, or master mechanics.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of industrial machinery repairers include machinists, millwrights, general maintenance workers, and mechanics of air-conditioning equipment, aircraft, automobiles, motorcycles, diesel engines, elevators, farm equipment, heating equipment, mobile heavy equipment, and refrigeration equipment.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Precision Machined Products Association, 6700 W. Snowville Rd., Brecksville, OH 44141.
Internet: <http://www.pmpa.org>
- The National Tooling and Machining Association, 9300 Livingston Rd., Ft. Washington, MD 20744.
Internet: <http://www.ntma.org>
- Associated General Contractors of America, 333 Carlyle St., Suite 200, Alexandria, VA 22314.
Internet: <http://www.agc.org>

Line Installers & Repairers

SOC CODES: 49-9051 and 49-9052

Significant Points

- Employment is expected to grow due to the expansion of telecommunications networks.
- A high school diploma or equivalent is required.

Nature of the Work

- *Line installer & repairers* construct and maintain vast networks that provide electrical power and communications services.
- Line installers, or line erectors, install new lines and string cables along poles, towers and trenches. Other duties may include setting up service for customers and installing a variety of network equipment.
- In addition to installation, line erectors also maintain electric, telephone and cable television lines.

Working Conditions

- Many line installers & repairers work a 40-hour week. Emergency situations may require overtime work and irregular hours to restore service.
- Line workers encounter serious hazards on their jobs and must follow safety procedures to minimize the potential danger. Electric power line workers have the most hazardous jobs due to high voltage wires and an increased risk of severe injury due to falls.
- The work of line installers & repairers often requires that they drive utility vehicles, travel long distances, and work outdoors under a variety of weather conditions. Therefore, they must be in good physical condition.

Employment

- Line installers & repairers held about 250,900 jobs in 2004 in the United States and approximately 7,300 jobs in Pennsylvania.
- Nearly one-quarter worked for cable television organizations. Over 22 percent worked for power generation and supply establishments. About 20 percent worked for telephone companies.
- The following table includes the industries that employed the most line installers & repairers in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Cable Subscription, Programming & Distribution	1,790	24.5%
Power Generation & Supply	1,670	22.8%
Wired Telecommunications Carriers	1,420	19.4%
Building Equipment Contractors	990	13.6%
Utility System Construction	540	7.4%

Job Outlook

- Employment of line installers & repairers in Pennsylvania is expected to grow from approximately 7,300 in 2004 to approximately 7,770 in 2014. Line installers and repairers can expect about 85 openings due to growth and about 208 replacement openings for approximately 293 total annual openings.
- Mergers among companies may result in layoffs. However, this will be offset by the growth of telecommunications networks.
- The need for network expansion in the distribution of electrical power is not as great. Therefore, the employment of electrical power line installers & repairers is projected to decline.

Earnings

- Average hourly earnings of electrical power-line installers & repairers were \$24.54 in 2005. The entry-level rate in 2005 was \$19.10 while an experienced electrical power-line installer & repairer made \$27.25.
- Average hourly earnings of telecommunication line installers & repairers were \$21.78 in 2005. The entry-level rate in 2005 was \$13.76 while an experienced telecommunication line installer & repairer made \$25.79.

Training, Other Qualifications and Advancement

Line installers & repairers must have a high school diploma or equivalent. However, many employers prefer applicants with some technical knowledge of electricity and electronics. Prospective employees should also possess a basic knowledge of math and have some mechanical aptitude. The ability to distinguish colors is necessary because wires and cables may be coded by color. Customer service and interpersonal skills are also important.

Electric power companies often require that their line installers & repairers complete apprenticeship or employer training programs. These programs last several years and combine formal instruction with on-the-job training. Line installers & repairers who work in telephone and cable television companies receive several years of on-the-job training. They may attend training provided by equipment manufacturers, schools, or industry training organizations. The Society of Cable Television Engineers (SCTE) provides certification programs for line installers & repairers.

Entry-level line installers are usually hired as ground men, helpers or tree trimmers. With experience, they may advance to positions stringing cable and performing service installations. Promotion to supervisory or training positions is also possible.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of line installers & repairers include electricians, broadcast and sound technicians, radio operators and telecommunications equipment workers.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Communications Workers of America, 501 3rd St. NW, Washington, DC 20001-2797. Internet: <http://www.cwa-union.org>
- Utility Workers Union of America, 815 16th St. NW, Washington, DC 20006. Internet: <http://www.uwua.org>
- Society of Cable Telecommunications Engineers, Certification Department, 140 Philips Rd., Exton, PA 19341. Internet: <http://www.scte.org>

Millwrights

SOC CODE: 49-9044

Significant Points

- Employers prefer to hire applicants with a high school diploma and some vocational training or experience.
- Over 90 percent worked for manufacturing or construction firms.
- Automation and technological advancements will contribute to employment decline.

Nature of the Work

- *Millwrights* install, repair, replace and dismantle the machinery and heavy equipment used in many industries.
- When new machinery arrives, it must be unloaded, inspected, and moved into position. Millwrights consult with production managers to determine the optimal placement of machines. In some instances, they prepare or supervise the construction of a new foundation for the machine.
- When assembling machinery, millwrights fit bearings, align gears, attach motors, and connect belts. Precision leveling and alignment are very important in the assembly process.
- Sophisticated automation results in complicated machines, which require millwrights to work with electricians, engineers, computer technicians, and electronics experts.

Working Conditions

- Many millwrights work more than 40 hours during a typical week. Overtime and shift work is common.
- Those employed by manufacturing firms often work in a typical shop setting and use protective equipment to avoid common hazards. Those in construction may work outdoors in uncomfortable weather conditions.
- Millwrights may work individually or as part of a team. They must work quickly and precisely because disabled machinery costs a company time and money.

Employment

- Millwrights held about 58,900 jobs in 2004 in the United States and approximately 2,450 jobs in Pennsylvania.
- About 59 percent worked in manufacturing. Construction companies employed another 32 percent.

Job Outlook

- Employment of millwrights in Pennsylvania is expected to decrease slightly from approximately 2,450 in 2004 to approximately 2,420 in 2014. About 60 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- Automation, technological advances and the growing utilization of lower-paid workers will contribute to the decline in millwright employment.
- There will be a greater need for repair work than for the installation of new machinery.

Earnings

Average hourly earnings of millwrights in Pennsylvania were \$19.35 in 2005. The entry-level rate for a millwright in 2005 was \$14.14 while an experienced millwright made \$21.96.

Training, Other Qualifications and Advancement

Employers prefer to hire applicants with a high school diploma or equivalent and some vocational training or experience. Millwrights normally train for four years through apprenticeship or community college programs. Both combine classroom instruction with on-the-job training. Continuing education is required for millwrights to keep their skills up-to-date on any technological advances.

Courses in science, mathematics, mechanical drawing, computers, and machine shop provide a good background for those interested in entering this occupation. Because millwrights assemble and disassemble complicated machinery, mechanical aptitude is very important. In order to lift and move heavy equipment, millwrights should be strong and agile. Millwrights usually work as part of a team and need good interpersonal and communication skills to be able to give detailed instructions to others.

For most millwrights, advancement takes the form of higher wages. Some will become supervisors or superintendents. Others may become self-employed contractors.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of millwrights include industrial machinery repairers, aircraft mechanics, ironworkers, machine assemblers, mobile heavy equipment mechanics, diesel mechanics, and farm equipment mechanics.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Associated General Contractors of America, 333 John Carlyle St., Suite 200, Alexandria, VA 22314. Internet: <http://www.agc.org>
- The Precision Machined Products Association, 6700 W. Snowville Rd., Brecksville, OH 44141. Internet: <http://www.pmpa.org>

Mobile Heavy Equipment Mechanics

SOC CODE: 49-3042

Significant Points

- Job opportunities should be best for graduates of formal training programs.
- Voluntary certification is available.

Nature of the Work

- *Mobile heavy equipment mechanics* repair and maintain the engine, transmission, hydraulic, and electrical systems that power graders, backhoes, and loading shovels.
- Increased use of electrical and computer-controlled components has made modern equipment more sophisticated. As a result, mechanics need additional training to diagnose and repair any problems.
- Mechanics use hand tools, power tools, welding equipment, and other precision equipment to lift and repair broken parts. Computerized diagnostic devices are also used to locate electronic malfunctions.

Working Conditions

- Work is usually performed in well-lit, well-ventilated repair shops. However, some shops are drafty and noisy.
- On occasion, it may be too difficult or expensive to bring equipment into the shop. In this case, field service mechanics travel to the job site and make repairs, usually outdoors.
- Mobile heavy equipment mechanics may have to handle dirty, greasy parts. To repair equipment, they may have to lift heavy items or work in awkward positions.
- Although minor cuts and bruises are common, serious accidents can be avoided if safety practices are observed.

Employment

- Mobile heavy equipment mechanics held about 124,500 jobs in 2004 in the United States and approximately 5,190 jobs in Pennsylvania.
- About 30 percent worked for wholesale distributors of machinery and equipment. Another 15 percent worked for government agencies. Almost 10 percent worked for commercial machinery repairers.
- The following table includes the industries that employed the most mobile heavy equipment mechanics in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Machinery & Supply Merchant Wholesalers	1,510	29.2%
Federal, State & Local Government	780	15.0%
Commercial Machinery Repair/Maintenance	490	9.4%
Electronic Markets & Agents/Brokers	380	7.3%
Other Specialty Trade Contractors	330	6.4%

Job Outlook

- Employment of mobile heavy equipment mechanics in Pennsylvania is expected to grow from approximately 5,190 in 2004 to approximately 5,590 in 2014. Mobile heavy equipment mechanics can expect about 40 openings due to growth and about 113 replacement openings for approximately 153 total annual openings.
- Opportunities should be best for graduates of formal training programs in diesel or heavy equipment mechanics.
- The increased complexity of new equipment will require well-trained mechanics. Therefore, applicants without formal training may have difficulty entering this occupation.
- Economic conditions can affect the demand for mobile heavy equipment mechanics. Although fewer mechanics are needed during slow seasons, most employers try to retain their experienced workers.

Earnings

Average hourly earnings of mobile heavy equipment mechanics in Pennsylvania were \$19.20 in 2005. The entry-level rate in 2005 was \$13.62 while an experienced mobile heavy equipment mechanic made \$21.99.

Training, Other Qualifications and Advancement

Although some mobile heavy equipment mechanics still learn their skills through on-the-job training, most employers prefer to hire mechanics that have completed a formal training program beyond high school. Many community colleges and vocational schools offer programs in diesel engine or heavy equipment repair. These one to two year programs provide a basic foundation in heavy equipment technology, electronics and diagnostic techniques. Upon completion, graduates earn a certificate or an associate's degree.

A combination of formal instruction and on-the-job training provides trainee mechanics with the knowledge to efficiently repair equipment. Newly hired mechanics perform routine service tasks and make simple repairs. As they prove their abilities, they are assigned to more difficult jobs. About three to four years of on-the-job experience are required to become a journey-level technician. Graduates of formal training programs may be promoted to the journey-level after only a few months.

Voluntary certification is available through the National Institute for Automotive Service Excellence (ASE). Mobile heavy equipment mechanics may be certified in any or all of six different areas of heavy-duty repair, including brakes, gasoline engines, diesel engines, drive trains, electrical systems, or suspensions. To earn ASE certification, applicants must pass at least one examination and have two years of hands-on experience. Completion of a formal training program may be substituted for up to one year of work experience. Applicants who pass all six examinations are awarded the designation of Master Heavy-Duty Diesel Technician. To retain certification, workers must retake the examination every five years.

Aspiring mobile heavy equipment mechanics need mechanical aptitude and knowledge of how heavy equipment works. They should be able to read, comprehend, and interpret service manuals. To keep abreast of new technologies, mechanics must be flexible and willing to learn new procedures. High school courses in automobile mechanics, physics, chemistry, and mathematics provide a strong foundation. Previous experience, such as that acquired in the Armed Forces, is also valuable.

Personal tools are very important to mechanics. Although employers usually furnish power tools and computerized testing equipment, mobile heavy equipment mechanics are expected to accumulate their own hand tools. Experienced workers have invested thousands of dollars in their tools.

Experienced mobile heavy equipment mechanics may advance to field service jobs, where they have more responsibilities and earn higher pay. Mechanics who demonstrate leadership skills may be promoted to shop supervisor or service manager positions. A few open their own shop or invest in a franchise.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of mobile heavy equipment mechanics include individuals that repair rail cars, farm equipment, diesel engines, motorcycles, boats, and small engine equipment.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Association of Equipment Management Professionals, PO Box 1368, Glenwood Springs, CO 81602. Internet: <http://www.aemp.org>
- Specialized Carriers and Rigging Association, 2750 Prosperity Ave., Suite 620, Fairfax, VA 22031-4312. Internet: <http://www.scranet.org>
- National Institute for Automotive Service Excellence, 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Internet: <http://www.asecert.org>

Precision Assemblers

SOC CODES: 51-2011, 51-2021, 51-2022, 51-2023, 51-2031, 51-2041, 51-2091, 51-2092, 51-2093 and 51-2099

Significant Points

- Increased automation and internationalization will dampen employment growth.
- Virtually all assemblers worked in plants that manufacture durable goods.

Nature of the Work

- ***Precision assemblers*** perform a series of complex tasks to produce intricate manufactured products, such as aircraft, automobiles, computers, and small electrical components. Individuals may work on subassemblies or the finished product.
- Product development specialists interpret engineering specifications from text, drawings, and computer-aided drafting systems. They may work with engineers and technicians to assemble prototypes or test products.
- As technology changes, so does the nature of the manufacturing process. Flexible manufacturing systems change the way goods are made and affect the jobs of precision assemblers.

Working Conditions

- Most precision assemblers work a 40-hour week, although overtime is fairly common. Work schedules may vary at plants where more than one shift is worked.
- Long periods of time are spent sitting or standing in one place.
- The increased use of robotics and other pneumatically powered machinery has improved working conditions by lowering the overall noise level at many facilities.

Employment

- Precision assemblers held about 2.0 million jobs in 2004 in the United States and approximately 77,020 jobs in Pennsylvania.
- Over 82 percent worked for companies that manufacture durable goods, such as plastic products, electronic components, motor vehicle bodies and laboratory instruments.

Job Outlook

- Employment of precision assemblers in Pennsylvania is expected to decrease from approximately 77,020 in 2004 to approximately 74,950 in 2014. About 2,018 annual openings will result from replacement needs. Although no net employment growth is expected statewide, growth openings may occur in some areas.
- The increased use of robotics is expected to raise the productivity of assembly workers but adversely affect the employment level. These effects will be less severe in some industries than in others.
- Manufacturing companies often send their subassembly or component production functions to countries where labor costs are lower. This growing internationalization of production will lead to growth in goods exportation and the creation of jobs in other industries.

Earnings

- In Pennsylvania, precision assemblers averaged \$12.30 to \$15.60 per hour in 2005. Entry-level rates were between \$8.40 and \$11.10 per hour, while experienced precision assemblers earned anywhere from \$14.30 to \$17.90 per hour.
- The following table includes the average hourly, entry level, and experienced level wages in 2005 for different precision assembler occupations in Pennsylvania.

Occupational Title	Average Hourly Wage	Entry Level Wage	Experienced Level Wage
Aircraft Structure, Surfaces, Rigging & Systems Assemblers	N/A	N/A	N/A
Coil Winders, Tapers & Finishers	\$14.34	\$10.50	\$16.25
Electrical & Electronic Equipment Assemblers	\$13.62	\$8.87	\$16.00
Electromechanical Equipment Assemblers	\$15.53	\$10.96	\$17.82
Engine & Other Machine Assemblers	\$15.25	\$10.61	\$17.58
Structural Metal Fabricators & Fitters	\$15.23	\$11.09	\$17.30
Fiberglass Laminators & Fabricators	\$13.15	\$9.75	\$14.86
Team Assemblers	\$12.35	\$8.41	\$14.31
Timing Device Assemblers, Adjusters & Calibrators	\$13.80	\$10.31	\$15.55
Assemblers & Fabricators, Other	\$14.15	\$8.70	\$16.87

- No Pennsylvania-specific wage information was available for aircraft structure, surfaces, rigging & systems assemblers. However, the national average hourly earnings of aircraft assemblers were \$20.45 in 2005.

Training, Other Qualifications and Advancement

Most precision assemblers are promoted from lesser skilled jobs within the company. Employees learn about the broad range of duties they may be required to perform through extensive on-the-job training or classroom instruction. Some jobs require specialized training, which is offered in technical schools and the Armed Forces.

Precision assemblers must be able to perform accurate work at a rapid pace. Manual dexterity and good eyesight are extremely important qualities when dealing with small parts. In addition, companies may test applicants for accurate color vision. In general, employers prefer to hire or promote high school graduates into entry-level assembler positions.

As assemblers gain experience, they may progress to jobs that require more skill and be given more responsibility. A few qualified assemblers become supervisors. Others take positions in product repair, quality control, or product development.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of precision assemblers include welders, ophthalmic laboratory technicians, and machine operators.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>

Radio & Telecommunications Equipment Installers & Repairers

SOC CODES: 49-2021 and 49-2022

Significant Points

- Opportunities should be best for applicants with electronics training and computer skills.
- Equipment repairers are usually on-call in case of emergencies.

Nature of the Work

- Radio & telecommunications equipment installers & repairers set up and maintain telephones, radios, electronic switches, and switchboards.
 - *Central office installers* set up switches and cables telephone central offices or hubs.
 - *PBX installers* set up private branch exchange (PBX) switchboards to relay incoming, outgoing, and interoffice calls for a single location or organization.
 - *Network technicians* or *telecommunications specialists* generally handle complex programming.
- The increasing reliability of telephone switches and switchboards has simplified maintenance. New telephone switches are self-monitoring and alert repairers to malfunctions. Some switches even allow repairers to diagnose and correct problems from remote locations.
- *Radio mechanics* install and maintain radio transmitting and receiving equipment. Newer radio equipment is also self-monitoring and may alert mechanics to potential malfunctions.
- *Station installers and repairers*, commonly known as *telephone installers and repairers*, install and repair telephone wiring and equipment on customers' premises. They may connect telephone wires to outside lines.

Working Conditions

- Many radio & telecommunications equipment installers & repairers work regular business hours. Schedules at some locations are irregular and may result in overtime, weekend and holiday hours. Repairers may be on-call around the clock.
- Telecommunications equipment specialists generally work full time in clean, well-lit, air-conditioned surroundings.
- Telephone installers & repairers often work outdoors on rooftops, ladders, and telephone poles. Likewise, radio mechanics may be subject to weather conditions while maintaining equipment located on the tops of transmissions towers.
- The work of most repairers involves lifting, reaching, stooping, crouching and crawling. Adherence to safety precautions is important to guard against work hazards.

Employment

- Radio & telecommunications equipment workers held about 221,700 jobs in 2004 in the United States and approximately 5,480 jobs in Pennsylvania.
- Over 62 percent worked in the information sector, primarily for telephone companies. Others were employed with electrical repair shops.

Job Outlook

- Employment of radio & telecommunications equipment workers in Pennsylvania is expected to grow from approximately 5,480 in 2004 to approximately 5,570 in 2014. These workers can expect about 9 openings due to growth and about 114 replacement openings for approximately 123 total annual openings.
- Opportunities should be best for applicants with electronics training and computer skills.
- The demand for installation and upgrading of switching equipment will stimulate employment growth of central office and PBX workers. However, increased reliability and automation will constrain employment growth.
- The increased reliability of wireless equipment and the use of self-monitoring systems will lessen the need for radio mechanics.

Earnings

- No Pennsylvania-specific information was available for radio mechanics. However, the average hourly wage nationwide for radio mechanics in 2005 was \$18.78.
- Average hourly earnings of telecommunications equipment installers & repairers were \$23.33 in 2005. The entry-level rate in 2005 was \$15.76 while an experienced telecommunications equipment worker made \$27.12.

Training, Other Qualifications and Advancement

Although newly hired telecommunications equipment specialists usually receive some on-the-job training, employers seek applicants with formal training in electronics. Training sources include two- and four-year college programs, trade schools, and manufacturer's training. Military experience is also highly valued by many employers.

Radio & telecommunications equipment workers must be able to distinguish between color-coded wires and hear distinctions in the various tones on a telephone system. Those who climb poles and towers should be in good physical shape. For workers who frequently contact customers, a pleasant personality, neat appearance, and good communications skills are important. A familiarity with computers and the ability to work independently are essential qualities.

Experienced radio & telecommunications equipment workers may become specialists or troubleshooters who help others diagnose difficult problems. They may work with engineers in designing equipment and developing maintenance procedures. Those with leadership ability can become maintenance supervisors or service managers. Some open their own repair shops or become wholesalers or retailers of electronic equipment.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of radio & telecommunications equipment workers include broadcast & sound technicians; computer, ATM & office machine repairers; electrical & electronics installers & repairers; electronic home entertainment equipment repairers; and electronics engineering technicians.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- International Brotherhood of Electrical Workers, Telecommunications Department, 1125 15th St. NW, Room 807, Washington, DC 20005. Internet: <http://www.ibew.org>
- Communications Workers of America, 501 3rd St. NW, Washington, DC 20001-2797. Internet: <http://www.cwa-union.org>
- United States Telecom Association, 1401 H St. NW, Suite 600, Washington, DC 20005. Internet: <http://www.usta.org>

Small Engine Mechanics

SOC CODES: 49-3051, 49-3052 and 49-3053

Significant Points

- Skills may be acquired through on-the-job training or while working in related occupations.
- Job prospects should be best for graduates of formal training programs.
- Roughly 1 in 7 were self-employed.

Nature of the Work

- Small engine mechanics repair and service power equipment, including motorcycles and boats. They also perform routine maintenance to minimize breakdowns and to keep engines operating at peak performance.
Motorcycle mechanics repair motorcycles, motor scooters, mopeds and all-terrain vehicles. They usually service one particular type of equipment.
Boat mechanics, also known as *marine equipment mechanics*, maintain inboard and outboard marine engines. Portable outboard engines are removed and brought into the repair shop. However, the engines of larger craft are usually repaired on-site.
Small engine mechanics service and repair outdoor power equipment such as lawnmowers, garden tractors, edge trimmers and chain saws. They may also repair snowblowers and snowmobiles, but demand for this type of work is seasonal.
- Mechanics use hand tools, power tools, hoists and computerized diagnostic equipment to perform repair work. Service manuals are used for detailed directions and specifications.
- Skilled mechanics are able to diagnose problems and make repairs in a minimal amount of time. This requires a thorough knowledge of the equipment's operation.

Working Conditions

- Small engine mechanics work considerably more than 40 hours a week when demand is strong. During the winter months, the demand for repair and service work declines.
- Most work is performed in repair shops, which may be noisy when engines are being tested.
- Occasionally, boat mechanics work outdoors at dock or marinas. When repairing a boat's engine, mechanics may be forced into awkward, cramped positions.

Employment

- Small engine mechanics held about 72,900 jobs in 2004 in the United States and approximately 2,850 jobs in Pennsylvania.
- One-third worked for retail dealers of motorcycles, boats and outdoor equipment. Another 19 percent worked for retail lawn and garden stores. About 1 in 7 were self-employed.
- The following table includes the industries that employed the most small engine mechanics in 2004 in Pennsylvania.

Industry	2004 Employment	Percent
Other Motor Vehicle Dealers	940	33.0%
Lawn & Garden Equipment/Supplies Stores	540	18.8%
Self-Employed	380	13.4%
Building Material & Supplies Dealers	180	6.4%
Household Goods Repair & Maintenance	150	5.4%

Job Outlook

- Employment of small engine mechanics in Pennsylvania is expected to grow from 2,850 jobs in 2004 to approximately 3,280 jobs in 2014. Small engine mechanics can expect about 43 openings due to growth and about 71 replacement openings for approximately 114 total annual openings.
- Increased personal income will allow consumers more disposable dollars to buy boats, motorcycles and power

lawn equipment. Qualified mechanics will be needed to maintain this additional equipment. Furthermore, routine maintenance will always be a significant source of work.

- Employment growth may be tempered by the tendency of many consumers to replace inexpensive items rather than have them repaired.
- Job prospects should be especially favorable for graduates of formal training programs.

Earnings

- Average hourly earnings of motorboat mechanics in Pennsylvania were \$13.72 in 2005. The entry-level rate in 2005 was \$9.39 while an experienced motorboat mechanic made \$15.88.
- Average hourly earnings of motorcycle mechanics in Pennsylvania were \$13.17 in 2005. The entry-level rate in 2005 was \$8.34 while an experienced motorcycle mechanic made \$15.59.
- Average hourly earnings of outdoor power equipment & other small engine mechanics in Pennsylvania were \$12.59 in 2005. The entry-level rate in 2005 was \$8.43 while an experienced worker made \$14.67.

Training, Other Qualifications and Advancement

Employers generally prefer to hire applicants who have completed a formal training program. However, the number of postsecondary programs is limited. Therefore, many of these mechanics still learn their skills through on-the-job training or while working in related occupations. In addition, organizations may hire high school students to fill part-time and summer positions. These workers help assemble new equipment, perform minor repairs, and gain valuable industry experience at the same time.

When filling trainee positions, employers look for high school graduates with mechanical aptitude. Basic reading, writing and arithmetic skills are essential. To recognize and fix potential problems, aspiring mechanics should be familiar with basic electronics principles and the fundamentals of small engines. Selected trainees assist experienced workers with simple tasks. After mastering the simple jobs, trainees progress to more difficult tasks. In general, it requires up to three years of on-the-job training to become skilled in all aspects of small engine repair.

To keep their skills up-to-date, many mechanics are sent to special training sessions conducted by equipment manufacturers and distributors. These training sessions, which can last up to two weeks, provide workers with information on repairing new models. Most mechanics that perform warranty work for manufacturers and insurance companies are required to attend these sessions.

Personal tools are very important to small engine mechanics. Although employers usually furnish power tools and computerized diagnostic equipment, workers are expected to accumulate their own hand tools. Many experienced mechanics have invested thousands of dollars in their tools.

Advancement opportunities are best for experienced small engine mechanics that demonstrate leadership skills. These mechanics may be promoted to shop supervisor or service manager positions. Individuals with sales abilities may take positions as sales representatives. Others open their own repair shops.

Related Occupations

Workers in other occupations with responsibilities and duties related to those of small engine mechanics include those who repair automotives, diesel engines, farm equipment and mobile heavy equipment.

Sources of Additional Information

- Pennsylvania CareerLink. Internet: <http://www.pacareerlink.state.pa.us>
- Motorcycle & Marine Mechanics Institute (part of Universal Technical Institute), 2844 W. Deer Valley Rd., Phoenix, AZ 85027. Internet: <http://www.uticorp.com>
- Outdoor Power Equipment Institute, 341 S. Patrick St., Alexandria, VA 22314. Internet: <http://opei.mow.org>